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Artificial Intelligence Techniques for Evaluating Employee Terminations on a Personal Computer

Henry H. Perritt Jr.

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ARTIFICIAL INTELLIGENCE TECHNIQUES FOR EVALUATING EMPLOYEE TERMINATIONS ON A PERSONAL COMPUTER

HENRY H. PERRITT, JR.*

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* Professor of Law, Villanova University School of Law. Member of the Bar: Virginia, Pennsylvania, District of Columbia, United States Supreme Court. S.B. 1966; S.M. 1970, Massachusetts Institute of Technology; J.D. 1975, Georgetown University Law Center.

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I. INTRODUCTION

This Article explains how a personal computer program can ask intelligent questions and decide what legal claims might be asserted by a terminated employee. Such a legal diagnostic program can be written by applying artificial intelligence techniques to legal analysis.¹

The approaches discussed in this Article were applied initially in a small Wrongful Dismissal Expert System (WDES) developed by the author² and Brian E. Meyers, a former student. The WDES permits a lawyer or client to evaluate an employment termination for legal theories which might be asserted to recover damages for the terminated employee. WDES asks a series of factual questions, most in multiple choice form, about the termination. The questions asked by the program are determined largely by user responses to previous questions. For example, the program does not ask follow-up questions for tort theories if the answers to certain basic questions indicate that further analysis of tort theories would not be fruitful. A transcript of the questions and answers may be printed out, or it may be "saved" to a disk file for incorporation in a client document, file memorandum, or electronic retrieval system.

After the user answers the questions, WDES provides preliminary

1. See generally Blodgett, *Artificial Intelligence Comes of Age*, A.B.A. J., Jan. 1, 1987, at 68 (describing ERISA Prohibited Transaction Exemption Analyst, corporate document modeler, and software trade secrets expert systems).

2. In addition to developing the program, the author has taught seminars for two years in artificial intelligence and legal reasoning. The program has been evaluated by a dozen or so practicing lawyers with expertise in employment law. They concluded that the program is interesting and useful, while recognizing that its practical utility would be restricted by limitations discussed in this Article.

guidance regarding the legal theories apparently supported by the user responses, thereby suggesting further avenues for useful legal research. The user can obtain analysis in both printed form and on the computer display, and can create a text file containing the analysis for subsequent incorporation into file memoranda or client correspondence. The program also aids the practitioner in locating major cases in a particular state by providing their citations and synopses. The program can store a "session" (the questions asked and the computer responses); therefore, a user may terminate a query session before completing it and resume it at a later time, or he may retrieve a session and modify certain questions in order to elicit different responses.

While WDES illustrates the practicability of a legal diagnostic expert system, it also has major limitations. Most significantly, WDES is not really very "smart." It plods through questions one at a time, asking questions based on the answers to previous questions. Once the user has answered all the questions posed, WDES plods through possible paragraphs of advice, presenting each paragraph only if its criteria were satisfied by the user's responses.

This Article begins where WDES ends: examining ways to build more intelligent legal diagnostic systems. In the interest of concreteness, this Article uses many examples from an enhanced wrongful dismissal expert system now being developed by the author. Two subjects, aside from logic and substantive legal doctrine, are important in identifying appropriate improvements: knowledge representation and interrogation strategy. It is relatively easy to program a computer to ask questions and record the answers entered by a user. A sophisticated legal diagnostic system, however, requires that the questions and answers be organized and evaluated according to a body of legal doctrine. Linking the doctrine and the program instructions is at the heart of expert system design. Moreover, WDES was written in a conventional programming language: Turbo Pascal. It would be difficult to describe the details of WDES to a reader lacking experience writing programs in Pascal; therefore, this Article uses the Prolog language as an expository tool.

The depth of legal analysis that can be accomplished by any micro-computer system is limited. The system discussed in this Article can decide whether, based on user responses to computer-generated questions, the basic elements of certain legal theories are satisfied, and can suggest starting points for further research. No one yet knows how to program a computer to analyze the facts and decide which legal precedents are most applicable.

In one sense, the expert system can be viewed as a means of translating between legal concepts and factual concepts in a way understandable to a lay client.³ Under this view, the efficacy of any such system can be evaluated according to (1) the degree to which the system expresses analytical conclusions and guidance in terms of useful legal concepts, and (2) the degree to which the system asks questions in common sense factual terms without using legal terms of art. When the factual predicates for legal duties are well defined and relatively narrow, the system succeeds best.

Any computer system within the current state of the art is limited by an inability to understand or to generate natural language. As a result of this inability, the expert system must build formal logical bridges between common sense factual queries and legal concepts. Also, most questions must be asked in a yes/no or multiple choice format to ensure that the user responds in a way which the system understands. The inability to work with natural language sometimes produces an awkward analytical style. For example, where the elements of a particular theory are each analyzed independently in separate paragraphs, rather than interdependently, the analysis paragraphs are likely to be redundant.

Part II of this Article explains what artificial intelligence is, shows how rule-based expert systems can mimic the logical processes used in some legal analysis, and explores how artificial intelligence and expert systems relate to schools of jurisprudence and logic. Parts III and IV probe two major issues that concern anyone undertaking to write a legal diagnostic system: classification or "knowledge representation" problems, and interrogation strategy. Part V introduces the legal theories used in diagnosing wrongful dismissal cases. Part VI explores in detail the choices which must be made when writing a useful wrongful dismissal diagnostic system in a new programming language called "Turbo Prolog." Turbo Prolog facilitates the translation of legal rules into statements that can be processed by widely available computers. It is used as a vehicle for exploring the choices that must be made in system design because statements in the language resemble legal rules.

3. Appendices A and B show user interaction. Appendix C shows the results of the system's analysis in legal terminology.

II. ARTIFICIAL INTELLIGENCE AND LEGAL REASONING

A. *Artificial Intelligence, Expert Systems, and Prolog*

Artificial intelligence⁴ is a term which refers to a computer's ability, through specialized design and programming, to solve problems normally thought to require human reasoning. Artificial intelligence and digital computers have common backgrounds; they grew out of World War II research into code-breaking and systems for aircraft and fire control.⁵ Both Alan Turing and Norbert Wiener, major contributors to the underlying theory of digital computers, suggested the connection between computers and human intelligence.⁶

Artificial intelligence emerged as a distinct branch of computer science in the late 1950s.⁷ At first, artificial intelligence concerned the process of problem solving as contrasted with computation or machine translation.⁸ Herbert Simon proposed a *General Problem Solver* (GPS) to solve problems in the way that humans do.⁹ Early tests suggested that GPS followed analytical paths similar to those evidenced by an undergraduate college student "thinking out loud."¹⁰ Further experimentation, however, showed that GPS was premised on two questionable assumptions: (1) all problems are pretty much alike, and (2) *formulating* a problem is simpler than *solving* it.¹¹

The GPS effort assumed that the core of intelligence is reasoning ability applicable to all domains of human knowledge. But efforts to translate natural human language, an objective important to the cryptographic and cryptanalytic communities, were unsuccessful.¹² These failures demonstrated that intelligence depends on the quantity of

4. The term generally is credited to John McCarthy, a co-founder of the artificial intelligence lab at MIT. J. HAUGELAND, *ARTIFICIAL INTELLIGENCE: THE VERY IDEA* 147 (1985).

5. A. HODGES, *ALAN TURING: THE ENIGMA* (1983); N. WIENER, *CYBERNETICS* 1-15 (2d ed. 1965).

6. See Turing, *Computing Machinery and Intelligence*, 59 *MIND* 433 (1950) ("I propose to consider the question, 'Can machines think?'").

7. J. HAUGELAND, *supra* note 4, at 176.

8. *Id.* As early as 1948, Norbert Wiener of MIT began to popularize the idea that computers and human beings solve problems in similar ways. See N. WIENER, *supra* note 5, at 116-32 ("Computing Machines and the Nervous System").

9. Allen Newell and Cliff Shaw joined Simon in his efforts, which were centered at Carnegie-Mellon University. J. HAUGELAND, *supra* note 4, at 176-77.

10. *Id.* at 180.

11. *Id.* at 183.

12. Alan Turing, for example, who made seminal contributions to the theory of automata (computers), developed his interest in the subject while working on secret efforts to break German ciphers and codes during World War II.

knowledge and the quality with which the knowledge is organized.¹³ Machine translators flounder with the problem of ambiguity in natural human language. Resolution of ambiguities in ordinary language depends on an understanding of context derived from an immense store of knowledge. The problem of natural language processing is of central importance to the problem of programming a machine to mimic human intelligence: "language communication is verbalization of thought."¹⁴ Language comprehension, like intelligent problem solving, requires effective acquisition and organization of knowledge.¹⁵

Despite the frustration of early promises that human-like general purpose problem-solvers could be developed, the early artificial intelligence effort nevertheless paid dividends. Certain artificial intelligence programming techniques make it easier to program ordinary computers to deal with symbolic, as opposed to numeric or textual, information.¹⁶ These techniques, sometimes referred to as "symbolic" or "declarative" programming, permit computers to process logical premises and syllogisms.

It is impossible for a computer to engage in legal analysis in a general way. Current artificial intelligence techniques depend on processing symbols; yet much of human reasoning cannot be represented by symbols.¹⁷ Some legal reasoning is symbolic, however, and some of it reflects application of deductive logic. It is those forms which can be simulated by a computer.

1. Rule-Based Expert Systems: Why They Present Manageable Challenges

In the mid-1960s, as powerful general-purpose artificial intelligence techniques proved difficult to develop, researchers turned their attention to special purpose methods designed to solve specific types of problems:

13. Lenat, *Computer Software for Intelligent Systems*, SCI. AM., Sept. 1984, at 204.

14. R. REICHMAN, GETTING COMPUTERS TO TALK LIKE YOU AND ME at xi (1985).

15. *Id.* at xii.

16. The paradigm is the LISP language, developed by John McCarthy at MIT. J. HAUGELAND, *supra* note 4, at 147. LISP is the programming language used by most American artificial intelligence researchers. Prolog was developed in Europe and only recently has begun to compete with LISP for attention.

17. See, e.g., Simon, *Bicentennial Address: Focus on the Social Sciences, Part II*, BULL. AM. ACAD. ARTS & SCI., Mar. 1982, at 46-47 (comparing the analytical aspects of problem solving with the more creative process of musical composition). See generally H. DREYFUS, WHAT COMPUTERS CAN'T DO: THE LIMITS OF ARTIFICIAL INTELLIGENCE (1979).

[I]t was found that programs with more particular "expertise"—in the form of idiosyncratic data structures, peculiar heuristics, and other shortcuts—perform better. These improvements, however, are purchased at a price: the resulting systems tend to be brittle specialists, *idiot savants* that shine at one narrow task but are helplessly inept at everything else.¹⁸

Expert systems are programs which address specialized domains without attempting to solve the more global problems associated with automating human cognition.¹⁹ Intelligent behavior requires a tremendous amount of knowledge which cannot be spoon-fed practically to state of the art computers and organized in any useful way. But expert systems, by specializing in a narrow domain, reduce the difficulties associated with knowledge acquisition and organization.²⁰

The challenges of applying artificial intelligence can be reduced further by writing expert systems to perform specific tasks within a narrow domain—in law, for example, by writing an expert system to perform a diagnostic function as opposed to performing a more sophisticated kind of legal reasoning.

2. The Turbo Prolog Language

Expert systems can be written in any computer language,²¹ but it is much easier to write them in the newer symbolic or declarative programming languages. One such language is Turbo Prolog, a version of the Prolog programming language²² designed to be user friendly and to take advantage of the features of IBM personal computers and compatibles.

Turbo Prolog permits one to program a computer by means of statements (rules) written in ordinary language. For example, one could represent the basic rule for finding a breach of contract with the following Prolog statement:

18. J. HAUGELAND, *supra* note 4, at 183.

19. *Id.* at 194.

20. Lenat, *supra* note 13, at 204.

21. As noted in the Introduction, the first version of the WDES was written in a conventional programming language called Turbo Pascal. More limited expert systems can be written with the "mail merge" capabilities of a word processing package. Sophisticated word processing programs permit users to create document generators that ask questions and include particular words, sentences, or paragraphs in an output document according to the answers to the questions. The output document need not be a will or a pleading that has legal significance; it might be merely advice or a check list for lawyer follow-up.

22. Prolog is an acronym for Programming in Logic. See generally W. CLOCKSIN & C. MELLISH, *PROGRAMMING IN PROLOG* 233-56 (2d ed. 1984) (ch. 10: "The Relation of Prolog to Logic").

breach_of_contract if capacity and promise and consideration and
breach.

Rules can be written at lower levels of abstraction, as well. The concept represented by the word "consideration" in the first rule could be the subject of the rule

consideration if bargained_for_benefit or bargained_for_detriment or promissory_estoppel

The existence of "promissory_estoppel" can be represented by assertion of the predicate

promissory_estoppel.

This is called a fact. Prolog rules can be used to obtain factual information from a user. The simplest example of this is a subgoal which asks the user a question at run time:

promissory_estoppel if ask("Did the promisee give up something because of the promise?") and affirm_answer.

and then checks to see whether the user has answered yes or no. The predicate "promissory_estoppel" exists only after the user is asked the quoted question, and only if the user has then responded affirmatively. A series of such facts and rules constitutes a Prolog program. A Prolog program thus can be a hierarchical system of legal rules written in a readily understandable shorthand.

The most interesting characteristic of Prolog is its inference engine.²³ Prolog clauses have the predicate standing alone on the left side of the "if" and one or more corresponding subgoals on the right side. The inference engine automatically "looks up" each subgoal on the right side of the "if." If the inference engine finds a clause whose left side (head) matches the subgoal, it proceeds to try to satisfy that clause's subgoals. If the subgoals cannot be satisfied, the inference engine automatically tries other clauses whose heads match the particular subgoal.

Consider, for example, the earlier rule for determining whether consideration exists. The Turbo Prolog inference engine interprets the rule as if it were written like this:

consideration if bargained_for_benefit.
consideration if bargained_for_detriment.
consideration if promissory_estoppel.

If a higher level rule (e.g., the one given for "breach_of_contract") has consideration as a subgoal, the inference engine automatically finds

23. An inference engine is part of a Prolog computer language interpreter or compiler which tries to match predicates on the right side of clauses with identical predicates on the left side of other clauses, thus resolving higher-level predicates by unification. See L. STERLING & E. SHAPIRO, *THE ART OF PROLOG* 79 (1986).

the three rules for consideration and checks to see whether any of them are true. If "bargained__for__benefit" is not true, the inference engine automatically checks the second consideration rule to see whether it is satisfied. If the second rule cannot be satisfied, the third rule is checked. The result is a computer program which automatically looks up rules to see whether they are applicable, and, if several applicable rules are found, checks each in turn until one has been satisfied.

In the examples given here, the phrases "breach__of__contract," "consideration," and "promissory__estoppel" can be thought of as labels for complex legal concepts—as terms or *predicates* in logical premises. One of the important choices to be made in writing a series of legal rules is deciding which concepts should be labeled, and thereby forming the terms of the rules. Computer scientists call this a *knowledge representation* problem. In law, knowledge representation is another name for classification of legal concepts. Legal knowledge representation is discussed further in Part III.

3. Why Micro-Computers?

Until relatively recently, most artificial intelligence applications involved software requiring the power of a mini-computer or a mainframe.²⁴ In the last two years, software employing artificial intelligence techniques has become available for micro-computers, although there is a tendency to regard micro-computer applications as being limited to relatively simple prototypes or "toy" programs. Major questions remain about the power of expert systems that can be written for micro-computers. Nevertheless, micro-computer applications have advantages.

One advantage is that micro-computers provide distributed access to computer resources. Some legal services are performed in central locations, but most are not. Legal research is a prototypical example of a centralized activity.²⁵ Computer applications closely associated with traditional research, such as LEXIS or WESTLAW, can be centralized without disrupting the normal conduct of a law practice. In contrast,

24. A "mainframe" is a room-sized computer, usually requiring special air conditioning and electrical power arrangements. A mini-computer is a refrigerator-sized computer. Mainframes and mini-computers usually are shared by several people using terminals. A micro-computer usually fits on a desk and is intended for individual use. The IBM PC and the Apple Macintosh are examples of micro-computers.

25. Written legal research materials must be centralized so they can be shared by many users. However, technology such as the optical disk may make it possible to disperse legal research materials at a reasonable cost, thereby eliminating the need to centralize.

diagnostic expert systems are more closely associated with the kind of analysis or evaluation done in individual lawyers' offices. The utility of expert systems requires that they be available in or close to lawyers' offices. Such accessibility could be provided by means of terminals connected to mainframes or mini-computers as well as by micro-computers. The problem with terminals linked to a mainframe or a mini-computer is the very high capital expenditure required. Micro-computers, on the other hand, can be purchased with relatively little capital outlay, thereby allowing a firm to experiment with expert systems without making a major financial commitment.

*The second advantage of micro-computers is that micro-computer software can be developed and improved more rapidly and cheaply than can mainframe or mini-computer software. "Off the shelf" software is available for mainframes and mini-computers, but a vastly more diverse universe of software products is available for micro-computers.

The frequency of innovation is greater for micro-computer software than it is for mainframe or mini-computer software. Some micro-computer software is more powerful than mainframe software. Many word processing packages for micro-computers perform better than word processing packages available for mainframes. Similarly, database²⁶ and spreadsheet programs²⁷ designed for micro-computers are more suitable for the needs of individual users than software designed for larger computers. There are two simple reasons for this: micro-computer software is cheaper to develop, and the micro-computer software market is larger than that of mainframe or mini-computer software.

Micro-computer software is more a consumer product than is software for mainframes or mini-computers. Many firms develop micro-computer software and offer it to a broad market. In contrast, software for mini-computers and mainframes is developed to a large degree by in-house specialized programming staffs. The financial commitment required to pay for two to six employee years to develop a mainframe or mini-computer expert system is much greater than the commitment required to purchase a \$500 or \$1,000 micro-computer product developed by someone else. In addition, a micro-computer expert system can be modified by an individual user without the risks as-

* This section, evaluating the second advantage of micro-computers, contains the author's assessment of current marketplace conditions.

26. A database is a structured file from which material can be retrieved quickly by referencing certain components of the material.

27. A spreadsheet program is a type of computer application software that makes it easy for users to enter numerical information and relationships into cells arranged like a matrix on the display presented to the user.

sociated with modifying a mainframe or mini-computer program. This potential for user modification allows an individual attorney to tailor an expert system to fit his or her own practice needs.

B. *Legal Reasoning and Logic*

Legal reasoning involves the application of logic, history, custom, and social justice.²⁸ Only the first of these, logic, can be applied artificially by a computer. The logical component of legal reasoning involves the logical derivation of legal conclusions from particular factual situations in light of some body of legal doctrine.²⁹ Legal analysis is generally recognized as involving both deductive and inductive reasoning.³⁰ Major portions of the latter mode of reasoning (and arguably certain parts of the former) involve classification:³¹ classifying a new factual situation so that it is determined to be a member of the same class represented by a decided case or covered by a statutory rule which applies to classes of persons and conduct.

This classification process requires applying labels at two levels: labeling the attributes of the new fact situation, and labeling the case or rule that defines the class. This classification model of legal reasoning³² involves linking two sets of objective facts defining a transaction by a successive set of characterizations. The first set of objective facts is the party behavior leading to the legal controversy. The final set of objective facts defining a transaction is the decision by a judge or jury finding liability or no liability. Between the two is a series of characterizations, or, in mathematical terms, "transformations." For example, the characterization closest to the facts of the party behavior might be the characterization of one party's conduct as a promise. Then, the promise characterization, combined with other characterizations, permits aggregation of the first set of characterizations into a second level characterization: breach of contract. Other characterizations are necessary to evaluate possible excuse and to assess damages.

If a legal question is not subject to logical analysis—or if one rejects

28. Meldman, *A Structural Model for Computer-Aided Legal Analysis*, 6 RUTGERS J. COMPUTERS, TECH. & L. 27, 30 (1977) (citing B. CARDOZO, *THE NATURE OF THE JUDICIAL PROCESS* (1921)).

29. *Id.*

30. Leith, *Logic, Formal Models and Legal Reasoning*, 24 JURIMETRICS J. 334, 348 (1984) (classification is inductive; logic is deductive); Note, *Emerging Computer Assisted Legal Analysis Systems*, 1980 B.Y.U. L. REV. 116, 118 (suggesting that all legal reasoning is accomplished by deduction or analogy).

31. Leith, *supra* note 30, at 341-42 (legal reasoning is class- or set-based).

32. Professor Hugh Gibbons of Franklin Pierce Law Center first suggested this characterization model to the author.

the proposition that there is any logical component to legal reasoning—one can forget about artificial intelligence applications in law, at least for the time being. But if at least part of legal reasoning is logical, then the potential for artificial intelligence applications in law deserves consideration.

The deductive mode of legal analysis requires the use of formal logic.³³ The chief conceptual tool which formal logic uses to explore the proper relations between premises and conclusions is the syllogism. This is a simple Aristotelian syllogism:³⁴

All lawyers are mortal.
Walter Taggart is a lawyer.
Walter Taggart is mortal.

In this syllogism, the first line is the major premise, the second line is the minor premise, and the third line is the conclusion. The predicate of the conclusion, "mortal", is referred to as the major term, and the subject of the conclusion, "Walter Taggart," is called the minor term. "Lawyer," the word which appears in both premises but not in the conclusion, is called the middle term. In this example of a syllogism, the correctness of the major premise depends upon the breadth of meaning of the term "lawyer." In deductive legal reasoning, the major premise corresponds to a rule of law and the minor premise corresponds to the facts of the case to be decided;³⁵ the middle term is the element of the rule to be satisfied in the particular case. It is axiomatic that a syllogism may be valid, but validity does not imply that either of the premises or the conclusion is true.

Consider the following legal syllogism:

Making bodily contact with another is a battery.
Joe made bodily contact with Jane.
Joe committed a battery against Jane.

In this example, the syllogism is valid, but the major premise is not a correct statement of a legal rule. The truth of the minor premise is dependent upon the truth of the facts asserted therein. Logical proof is not helpful in determining the truth or falsity of the conclusion.³⁶

33. Formal logic is "the science of the principles of deductive reasoning—the study of the forms by which valid inferences may be drawn, without regard for the subject matter." Comment, *A Computer Method for Legal Drafting Using Propositional Logic*, 53 TEX. L. REV. 965, 965 (1975).

34. ARISTOTLE, *Analytica Priora*, in THE BASIC WORKS OF ARISTOTLE (R. McKeon ed. 1941).

35. S. BURTON, AN INTRODUCTION TO LAW AND LEGAL REASONING 48-49 (1985).

36. The inherent limitation of rule-based legal expert systems is that rules are only a superficial manifestation of law. Characterization (deciding whether a factual situation

Nevertheless, isolating the steps in the legal reasoning permits particularized consideration of their truth or falsity.³⁷

The use of symbols facilitates the evaluation of premises and terms in logic;³⁸ such use is called symbolic logic.³⁹ One kind of symbolic logic is called first-order logic.⁴⁰ Predicate⁴¹ calculus is a type of first-order logic with a defined syntax, permitting the use of variables in expressions.⁴² Propositional logic⁴³ is a special application of Boolean algebra.⁴⁴ In propositional logic, the premises can be represented by letters or symbols as well as by ordinary language.⁴⁵ Both propositional calculus and predicate calculus are useful in deriving rules in the IF-THEN form.⁴⁶ To say "Fred is a man" in predicate calculus, one would write something like $\text{Man}(\text{Fred})$. To say "All men are mortal," one would write $\text{All}(x)[\text{Man}(x) \rightarrow \text{Mortal}(x)]$ (for all things x , if x is a

matches the middle term in a syllogism) is not an inconvenience: it is the essence of legal reasoning.

37. See Allen, *Symbolic Logic: A Razor-Edged Tool for Drafting and Interpreting Legal Documents*, 66 YALE L.J. 833 (1957) (using symbolic logic principles in drafting reduces ambiguity); Allen & Orechkoff, *Toward a More Systematic Drafting and Interpreting of the Internal Revenue Code: Expenses, Losses and Bad Debts*, 25 U. CHI. L. REV. 1 (1957) (using symbolic logic facilitates the understanding of statutes); Comment, *supra* note 33, at 965.

38. I. COPI, *INTRODUCTION TO LOGIC* 277 (1982) (explaining use of symbols by Aristotle and comparing with modern symbolic logic).

39. "Symbolic logic covers the same field as formal logic; but whereas formal logic uses ordinary language for the most part, symbolic logic uses special symbols for its subjects and deductive processes. The use of symbols in logic produces the same results as in other branches of mathematics: greater precision, generality, and flexibility through abstraction." Comment, *supra* note 33, at 966 (footnotes omitted).

40. "First order" implies that universal and existential quantifiers cannot be used.

41. Predicate refers to the second term in a statement like, "No politicians are liars." It is a characterization of an object or a class. A class is the collection of all objects that have some specified characteristic in common. See *supra* text at notes 28-32.

42. The words "calculus" and "logic" are used interchangeably. Predicate calculus differs from propositional calculus in that predicate calculus permits variables and constants to be used in expressions. Thus predicate calculus permits the attribute to be separated from the object that possibly possesses it. See N. NILSSON, *PRINCIPLES OF ARTIFICIAL INTELLIGENCE* 135-36 (1980); see also McCarty, *Permission and Obligations*, in *COMPUTING POWER AND LEGAL REASONING* 573, 862 n.70 (C. Walter ed. 1985).

43. Propositional logic is "the analysis of relationships between propositions. A proposition is simply a statement having the property of being either true or false." Comment, *supra* note 33, at 966.

44. Boolean algebra is a branch of mathematics which permits true/false predicates or variables to be combined in equations which are themselves either true or false according to the algebraic rules.

45. See Note, *supra* note 30, at 119.

46. The if-then form expresses the idea that consequence X will result when fact Y has been proven: "If X , then Y ." This idea is "basic to legal drafting." Comment, *supra* note 33, at 968.

man then x is mortal). Rules of inference allow deductions to be made: for instance, to deduce that Fred is mortal from the above two facts.

Syllogistic logic can be an artificial, and, therefore, an unhelpful, legal tool. Syllogisms are useful only when their terms clearly and definitely express legal concepts generally shared by legal decision-makers.⁴⁷ "It might be said that the less articulate, precise, and narrowly drawn the norms of the law are, the less use can be made of the syllogistic method."⁴⁸ The methods of formal logic permit one to eliminate *syntactic* ambiguity in legal analysis, but not *semantic* ambiguity.⁴⁹

In addition, propositional logic and predicate calculus require that sentences be structured in the if-then form and in terms of phrases that are either true or false.⁵⁰

C. *Deductive Logic and Jurisprudence*

The development of computer programs for legal analysis has intellectual roots in the analytical school of jurisprudence founded by the English jurist, John Austin (1790-1859).⁵¹ In Austin's view, jurisprudence seeks to define and classify legal concepts such as rights, obligations, injuries, and remedies.⁵² The eighteenth century codification effort assumed that, by the use of logic, fundamental postulates could be discovered and detailed rules derived.⁵³ "John Stuart Mill, in his *Treatise on Logic*, asserted that under a written code the method of reasoning which a judge follows is wholly and exclusively a method of syllogistic reasoning."⁵⁴

Analytical jurisprudence is not without its detractors. Mr. Justice Cardozo observed that "the tyranny of concepts is a 'fruitful parent of injustice.'" ⁵⁵ Gideon Gottlieb pointed out that mechanical analytic jurisprudence frequently conceals the difficult aspects of legal reasoning.⁵⁶

47. See E. BODENHEIMER, JURISPRUDENCE: THE PHILOSOPHY AND METHOD OF THE LAW 337 (1970).

48. *Id.*

49. Comment, *supra* note 33, at 968.

50. "'Greater than,' 'all,' and 'some' are logic expressions, but not *propositional* logic expressions." *Id.*

51. Some commentators credit Jeremy Bentham with founding the analytical school, but Bentham's views were permeated with philosophical views about the ends of the law and the values which the institution *should* serve. E. BODENHEIMER, *supra* note 47, at 93.

52. *Id.* at 95.

53. See G. GOTTLIEB, LOGIC OF CHOICE 16 (1968).

54. *Id.*

55. E. BODENHEIMER, *supra* note 47, at 331 (citing B. CARDOZO, THE PARADOXES OF LEGAL SCIENCE 61 (1928)).

56. G. GOTTLIEB, *supra* note 53, at 17-18.

Simply articulating a major premise (rule) and a minor premise (facts) that constitute a syllogism producing a legal conclusion begs the hardest question in legal decision-making: What *are* the appropriate premises?

Choosing between competing major premises or deciding exactly how to articulate the middle term—which defines the relevant facts—cannot be done by applying the syllogism. “Nor can questions about factual situations not contemplated in the major premise of the syllogism, such as questions involving novel factual circumstances, be deductively resolved by resort to premises antecedent to such circumstances.”⁵⁷

Artificial intelligence implicitly adopts an analytical approach to law, but does not deny that important aspects of legal analysis and decision-making involve matters that cannot be encoded precisely in rules and classifications. As noted in the preceding section, characterization is at the core of legal reasoning, and characterizations are made prior to the application of syllogistic reasoning. Artificial intelligence merely tries to use legal rules for their worth and recognizes that resulting computer programs will be useful only where the legal concepts are sufficiently precise and concrete to make them amenable to translation into rules and terms with reasonably precise meaning. In other words, no one knows how to program a computer to decide the hard cases; however, one can, using artificial intelligence techniques, program a computer to identify the easy cases.

The challengers of the formal deductive logic model of legal reasoning have offered nothing equally useful to replace it.⁵⁸ Although all of legal reasoning cannot be reduced to a species of formal deductive logic, formal deductive logic is still a useful paradigm for certain forms of legal reasoning because not all legal decisions or legal advice involve an extraordinarily high level of legal analysis.

The vast majority of problems presented to lawyers involve repetitive types of transactions whose legally important facts can ordinarily be predicted in advance. The vast majority of lawyers evaluate cases by applying what they consider to be relatively subtle rules, without seriously questioning whether competing principles or policies exist. Though there are important differences, which will be noted below, this relatively mechanical process is common in a variety of circumstances: when personal injury plaintiff lawyers evaluate automobile accident or

57. *Id.* at 18.

58. “These critics were then left without *any* models of rational inference which they could have preferred to theories assimilating legal reasoning to feeling, emotion, sensory experience or unanalyzed personal predilection.” *Id.* at 24.

slip and fall cases; when labor lawyers evaluate claims of employment discrimination; when administrative personnel in the Social Security Administration or insurance carriers evaluate Medicare claims; when initial decisions are made on unemployment compensation claims; and when a variety of license or permit applications are acted upon.

In some of these examples, the real question is not the application of a hierarchy of syllogisms, but rather, is the availability of evidence to establish a minor premise. The clearest example is in the evaluation of a negligence claim. The negligence liability concept can be adequately expressed by a single major premise encompassing duty, breach and causation. The real question in case evaluation and decision-making involves the persuasiveness of factual evidence as to each of the major elements.

The other examples, however, involve the application of a more complicated hierarchy of major premises. In these cases, though the ultimate decision may turn on the persuasiveness of evidence to establish minor premises, the initial task is to apply an accurate understanding of the hierarchy of major premises. In such cases, reasonable simplification consists of applying factual assertions of the client for the minor premises (assuming these will be a proxy of the most favorable evidence that can be obtained for the client) and examining whether the hierarchy of major premises can be satisfied by these assertions.

The relationship between Prolog and legal analysis can be restated as follows. The analytical approach to jurisprudence implies the use of logic. Symbolic logic is a powerful tool for abbreviating terms, premises, and syllogisms. First-order symbolic logic permits a relatively mechanical form of proof to determine if conclusions are valid. The predicate calculus is a subset of first order predicate logic which facilitates theorem-proving. Prolog is a computer programming language which automates theorem-proving in predicate calculus.

III. LEGAL KNOWLEDGE REPRESENTATION: THE CLASSIFICATION DILEMMA

A. *Legal Knowledge Representation in General*

One of the essential functions of the law is to classify the phenomena and events of social life.⁵⁹ Legal concepts "may thus be viewed as working tools for the purpose of identifying, by a shorthand description, typical situations which are characterized by identical or common ele-

59. E. BODENHEIMER, *supra* note 47, at 325.

ments."⁶⁰ "When legal concepts are formed and defined, the most typical cases exemplifying the particular concept are usually taken into account, while the boundary cases are not clearly envisioned."⁶¹

Both inductive and deductive modes of legal reasoning require the labeling of particular attributes of transactions. Classification, the heart of inductive reasoning, involves the identification of relevant classes, which are in turn defined by particular attributes.⁶² Both class definition and subsequent classification of potential class members are divided according to attributes. Deduction requires the prior specification of the attributes which will be used as the terms in logical clauses. Deciding which attributes are important is known to artificial intelligence researchers as *knowledge representation*.

Legal knowledge representation interested legal philosophers long before computers existed. As noted in Part II, logic-based models of legal reasoning emphasize the classification of legal concepts. Models requiring classification require a classification system. The bridge between traditional jurisprudence and modern jurimetrics⁶³ is a 1919 book by Wesley Hohfeld.⁶⁴ Professor Hohfeld divided legal concepts into four elements: rights, privileges, powers, and immunities. Although some of Hohfeld's determinations of fundamental concepts became incorporated into the American Restatement of Property, the courts failed to adopt Hohfeld's approach and continued to use concepts of right, duty, privilege, and immunity in nonuniform and inconsistent ways.⁶⁵ Hohfeld's work was the last major effort in the school of analytical jurisprudence.⁶⁶

In the 1960s Georg von Wright introduced a concept called deontic logic.⁶⁷ Hohfeld's and von Wright's efforts were aimed at establishing broad classifications to divide the universe of legal concepts. Von Wright used mathematical logic (predicate calculus) to describe obligations that run between persons. Under this approach, legal doctrine

60. *Id.* at 329.

61. *Id.*

62. See generally JOHN STUART MILL, A SYSTEM OF LOGIC, bk. I, ch. VII, § 1 (8th ed. 1959).

63. The effort to express legal concepts in mathematical terms is called "jurimetrics," a term attributed to Lee Loevinger. See Loevinger, *Jurimetrics: The Next Step Forward*, 33 MINN. L. REV. 455 (1949).

64. W. HOFELD, FUNDAMENTAL LEGAL CONCEPTIONS AS APPLIED IN JUDICIAL REASONING (1919). Wesley N. Hohfeld was a Professor of Law at Yale University; he undertook a systematic classification of fundamental concepts in legal science.

65. Roscoe Pound criticized the Hohfeldian concepts. See Pound, *Fifty Years of Jurisprudence*, 50 HARV. L. REV. 557, 573-76 (1937).

66. Meldman, *supra* note 28, at 34.

67. See G. VON WRIGHT, NORMS IN ACTION (1963).

could be expressed mathematically in terms of commands and permissions relating sources of authority to the acts and forbearances of individuals.⁶⁸ These acts and forbearances, in turn, would be expressed mathematically in terms of elementary states of affairs and transitions between states.⁶⁹ A relatively recent effort to apply these concepts is reported by Jeffrey Meldman of the Massachusetts Institute of Technology.⁷⁰

Two related issues in legal knowledge representation are the need for an hierarchical structure, and the need to express relations between entities (such as duties). An hierarchical structure permits converting higher level abstractions, such as Hohfeldian duties, into more specific, lower level concepts that relate more directly to facts of actual transactions.⁷¹ A top-down design of a knowledge representation system starts with the higher level abstractions.⁷² A bottom-up design starts with types of objects and persons and types of relations or action between them.⁷³ If one envisions this hierarchy as a tree structure, one would refer to going from the specific to the more general as "descending the tree," and one would refer to the process of going from the general to the specific as "ascending the tree." The ability to express relationships between entities⁷⁴ is, of course, necessary in representing conceptions involving actors, conduct, and objects of the conduct.

The West key number system is a knowledge representation system that exhibits hierarchy, but does not permit relations between entities to be represented easily. The West system divides the entire body of law into 444 subject classifications. These classifications are subdivided into key numbers. For example, the subject Federal Civil Procedure has 2748 key numbers, Labor Relations has 1658 key numbers, and Criminal Law has 1216. Some subjects have relatively few key numbers (Electricity: twenty-one; Seamen: thirty-four; Indians: thirty-nine). This is a relatively shallow, hierarchical classification system for legal knowledge.

Hohfeld's system starts at a higher level of abstraction than does the

68. Allen, *Formalizing Hohfeldian Analysis To Clarify the Multiple Senses of "Legal Right": A Powerful Lens for the Electronic Age*, 48 S. CAL. L. REV. 428 (1974) (expressing Hohfeldian concepts in formal logic).

69. Meldman, *supra* note 28, at 35. For a recent application of deontic logic, see Leith, *On Some Logical Characteristics of Legal Norms*, 15 JURIMETRICS J. 160 (1975).

70. See Meldman, *supra* note 28; see also McCarty, *supra* note 42, at 573.

71. McCarty, *supra* note 42, at 862. Meldman calls this "decomposition." Meldman, *supra* note 28, at 42-43.

72. The Hohfeldian system and deontic logic are examples of such a system.

73. See, e.g., Meldman, *supra* note 28, at 28 (Meldman's system).

74. Meldman calls these "structural relations." *Id.* at 43.

West key number system. It is not expressly hierarchical; however, by expressing legal knowledge in terms of rights, duties, obligations, and privileges, the Hohfeldian system permits legal relationships between persons to be expressed more easily than does the West system. Nevertheless, hierarchy is a desirable feature of a legal knowledge representation system because it enables one to discern the "vertical" relationship of various concepts. In this sense, "vertical" means moving, within the same concept, from the general at the bottom of the hierarchy to the specific at the top.

There are pervasive knowledge representation problems in the application of artificial intelligence techniques to legal reasoning. These problems have three primary formulations. First, inductive reasoning, in which abstract legal rules are inferred from specific fact situations or cases, requires identification of the relevant facts from each example or case. Deciding which facts are legally significant is a knowledge representation problem. Second, designing more intelligent legal databases also requires one to decide which kinds of legal concepts ought to be indexed for individual cases. Third, expressing legal doctrines in rule form⁷⁵ requires one to decide which terms ought to appear in the rules.⁷⁶

Lawyers, judges, and legislators classify cases and develop rules intuitively, using natural language. Conducting legal analysis with a computer requires a less intuitive approach; it requires the use of labels or tags because computers cannot deal with the complexities of natural language. Thus, the knowledge representation and predicate calculus strands of development converge.

B. *Legal Knowledge Representation Problem Illustrated*

Consider how various legal knowledge representation systems would permit the case of *Wagenseller v. Scottsdale Memorial Hospital*⁷⁷ to be classified. The syllabus for that case is

At-will employee brought action for wrongful discharge against hospital and certain hospital employees. The Superior Court . . . entered summary judgment in favor of defendants, and employee appealed. The Court of Appeals . . . affirmed in part and remanded, and employee appealed. The Supreme Court . . . held that: (1) employer may

75. Legal rules are developed, for example, when legislation is drafted, when restatements are written, and when rule-based artificial intelligence programs for deductive legal reasoning are designed.

76. Only this third problem, relating to deductive reasoning, is discussed in this Article.

77. 147 Ariz. 370, 710 P.2d 1025 (1985).

not fire at-will employee for bad cause; (2) termination of at-will employee for refusal to commit an act which might violate indecent exposure statute may provide basis of claim for wrongful discharge; (3) there was issue of material fact, precluding summary judgment, as to whether provisions of employment manual had become part of employment contract; (4) implied covenant of good faith and fair dealing does not create duty for employer to terminate employee only for good cause; and (5) there existed genuine issue of material fact as to whether supervisor intentionally and improperly interfered with employment relationship. . . .

Affirmed in part, reversed in part, and remanded.⁷⁸

The case has thirty-seven headnotes, including Master and Servant Key Numbers 1, 3(1), 7, 20, 30(1.5), 30(1.10), 30(1.20), 30(6.30), 40(1), and 341, and several key numbers in Contracts, Judgment, Trial, and Torts topics. These key numbers permit one to classify the case in the West key number hierarchy according to subjects addressed by the case. The West Master and Servant topic is divided into these major subtopics: The Relation, Services and Compensation, Master's Liability for Injuries to Servant, Liabilities for Injuries to Third Persons, and Interference with the Relation by Third Persons. The key numbers indexing *Wagenseller* are within The Relation subtopic, specifically concerning "Creation and Existence" and "Termination and Discharge."

The West system permits one to classify the case as involving formation or termination of the employer-employee relationship. The case is not about employer-employee relationships in the abstract; it is about an employer's duty to not terminate the relationship. But the West system does not permit one to classify the termination in terms of the source of possible duties to not terminate. In other words, the West system does not facilitate matching aspects of the termination transaction with specific duties not to (1) jeopardize public policy or (2) violate contractual obligations. An alternative knowledge representation system might distinguish between sources of employer-employee duties derived from societal interests and those derived from private undertakings. The West Master and Servant topic is organized somewhat differently.⁷⁹

Organizing employment termination concepts based on the sources of duties not to terminate requires a far more sophisticated system than

78. *Id.* at 370, 710 P.2d at 1025.

79. The magnitude of the natural language problem would be narrowed by creating a parser for West headnotes. The key number for the headnote would narrow the domain significantly, giving an appropriate context for the parser. The output of the parser presumably would be a finer classification than is possible under the West key number system.

the mere determination that the terms "public policy" and "contractual" appear in the case.⁸⁰ It is desirable to capture more specific detail about structural relationships.⁸¹

In capturing structural relationships, one wants to preserve a hierarchy to represent greater generality or, conversely, greater specificity in concepts. Consider the utility of hierarchy in expressing the duty involved in the *Wagenseller* case. "Duty" is a very abstract concept. There are many different kinds of duty. One type of duty in this particular case is a contractual duty. More specifically, it is a duty arising out of a unilateral representation by an employer. The unilateral employer representation is the *source* of the duty. There is another dimension to the duty: its *subject matter*. The case involves a duty to observe pre-termination procedures. More specifically, it involves a duty to follow a four-step disciplinary process. Consider two top-down alternatives for representing these ideas. One could begin with the source—contract—and then divide contractual duties into those running between employers and employees. Or, like West, one could start with employer-employee relations and subdivide by other categories.

Alternatively, one could represent these ideas from the bottom up, following Meldman's suggestion that the basic pieces for representing factual situations be *things* and *relations*.⁸² The bottom-up approach has one important advantage: one can stop when one has reached a level of abstraction apparently sufficient to encompass a particular legal specialty. The top-down approach (at least if it starts at the Hohfeldian level) requires one to deal with the entire body of law. Meldman starts by dividing things into the categories people, objects, judgments, and events.⁸³ He divides relations into the categories kind of, part of, parent of, value of, attorney of, owner of, expectation of, and belief of. It quickly becomes apparent that the Meldman approach requires one to accommodate the entire body of natural occurrences.

Rarely is there only one way to represent the facts of a transaction. Any approach encounters difficulties in meeting both specificity and generalization goals. One probably could construct a knowledge representation system which would be perfectly adequate for the *Wagenseller* case, and, in the abstract, perhaps adequate for other cases involving

80. See Harty, *The "Key Words in Combination" Approach*, 1962 MODERN USES LOGIC L. (now JURIMETRICS J.) 54, 62.

81. Meldman has observed that key word searching represents the ultimate in decomposition, but that it lacks any representation of structural relations. See Meldman, *supra* note 28, at 43-44.

82. *Id.* at 44.

83. *Id.* at 45.

duties between employees and employers as well. It is highly unlikely, however, that such a knowledge representation scheme would accommodate all cases comfortably. Even if a knowledge representation system that accommodated all past cases were designed, a future case might not fit within the system. This is what Hart meant by describing legal concepts as "open textured,"⁸⁴ and what Levi meant by describing law as a "moving classification system."⁸⁵ Most people who have tried to develop a personal indexing system for something, such as files, cases, or litigation documents, have had the experience of believing the classification system adequate and then discovering a particular instance not fitting comfortably within the classification scheme.

The example of the knowledge representation problem in the context of the *Wagenseller* case is also useful to illustrate that the world of legal reasoning is not really divided between deductive reasoning and inductive reasoning. One can express both general doctrines and the holding of particular cases by IF-THEN rules. The IF-THEN rule of a particular case is merely a less general expression of the IF-THEN rule representing the doctrine. For example, one might frame a general rule of labor law, of which the *Wagenseller* case is an example, like this: If an employer promises to exercise its right to dismiss employees only under certain circumstances and a validation device for the promise is present, and the employer dismisses an employee when the circumstances do not exist, then the employer is liable for breach of contract to the employee. The holding of the *Wagenseller* case could be put more specifically: If an employer promises in a handbook to dismiss employees only after following a four-step disciplinary process, and the employer dismisses an employee without following the four-step process, then the employee can recover for breach of contract.

The rule in its general form is the necessary inference of a number of cases involving facts as specific as *Wagenseller*, some involving oral promises and some involving handbooks, some involving promises to dismiss only for good cause, and some involving promises to dismiss only after following certain procedures. These would be characterized as positive examples in which the duty exists. The boundaries or limits of the general rule could be inferred from "negative examples," and likely would include those cases in which the right to the benefits had not yet vested. Deriving the general rule from the individual cases is

84. McCarty, *supra* note 42, at 839.

85. *Id.*

the process of inductive reasoning.⁸⁶

C. *Managing Knowledge Representation Problems by Concentrating on Deductive Reasoning in a Narrow Legal Subject Matter*

The type of program discussed in this Article avoids the unresolved legal knowledge representation problems by concentrating on diagnosis in a narrow area of law. In such a narrow area, a knowledge representation system can be developed that will serve satisfactorily for the limited purpose diagnosis: evaluating potential legal theories given the facts of a particular employment termination.

Diagnosis can be performed through deductive reasoning, thus avoiding some of the problems associated with automating inductive reasoning.⁸⁷ The strategy is to mitigate knowledge representation problems by focusing the artificial intelligence effort narrowly. The human expert uses inductive reasoning to summarize a specialized area of the law in a set of rules which then are applied in an expert system.⁸⁸ Writing these rules is not a trivial task. Legal writers perform this task when they attempt synthesis of case law. Selecting an appropriate classification system or knowledge representation scheme requires expertise in the subject matter.⁸⁹

Useful diagnostic systems are more difficult to write for legal applications than for medical applications. In medicine, the raw facts from which an expert can make a diagnosis are mostly quantitative, relating to temperature, physical and chemical properties of the blood, and the presence of specific kinds of bacteria or viruses. These facts can be represented relatively easily in predicate calculus or in a rule-based system testing numerical ranges. Using natural language to communicate these facts is undesirable because natural language potentially distorts the facts. In medical diagnosis, the necessity of reporting facts to the computer system without natural language improves the reliability of system operation.

86. Artificial intelligence techniques for legal inductive reasoning are beyond the scope of this Article, although they are discussed briefly in Part VII.

87. These problems are considered in Part VII of this Article.

88. Professor Smith and graduate student Dittman at British Columbia School of Law are developing a system to apply case law principles to tort recovery for emotional distress.

89. The present author has developed such expertise and begun the classification process with his treatise *Employee Dismissal Law and Practice*. The treatise is divided into nine chapters and approximately 150 individual sections. Each section is further divided into pages, paragraphs, and footnotes. This is a useful starting point for developing more specific predicates and rules in a computer program which can diagnose wrongful dismissal cases.

Legal diagnosis is entirely different. The raw facts from which a diagnosis is made exist in terms of natural language; one understands and communicates the transactions that potentially have legal consequences by means of natural language. In law, the inability of state of the art software to deal reliably with natural language introduces an important set of constraints on the way in which the facts can be collected. Another limitation of rule-based legal expert systems is that they do not deal well with conflicting conclusions. For example, if two cases conflict, or if two commentators have conflicting views, it is difficult to encode this in rule form. One way to avoid the problem is to have a rule which simply informs the user of the existence of the conflict.

The narrowing of the area of discourse to a specific subject matter avoids the natural language barrier and reduces the knowledge representation challenge. But there is even more important narrowing of focus associated with the expert systems discussed in this Article: a focus on diagnosis of legal problems. Many of the objections to formal deductive logic as a model of legal reasoning are associated with legal decision-making—the kind of legal reasoning engaged in by judges and legislators. Such decision-makers must choose between conflicting principles and policies, thereby deciding which major premise to select, and they frequently are confronted with fact patterns (minor premises) which do not match neatly with the middle term of a major premise. To avoid these difficulties, the expert systems discussed in this Article concentrate on a diagnostic rather than a decision-making function. This concentration has a number of implications, some positive and some negative.

The positive implications are that most cases presented by clients are easy cases. Therefore, the appropriate rules for screening and organizing client fact information can be written in advance with some degree of confidence. A system easily can be designed so that fact patterns not foreseen by the system can be handled as exceptions.

A further advantage is that much initial client interviewing is already mechanical, albeit not computerized. Persons conducting initial client interviews must reduce the body of law in a particular area to a set of reasonably precise rules and to evaluate facts given by the client according to those rules, thereby assessing the likelihood of a successful claim under the law as it then exists.⁹⁰ Moreover, many initial interviews are conducted not by skilled legal specialists, but by less skilled professional or para-professional personnel. Assuming that such persons conduct

90. Some legal services clinics are currently using artificial intelligence systems with considerable success.

interviews, the legal system already has crossed a bridge: forbearing to apply the highest level of legal expertise in the interview, and instead accepting a more mechanical interview process to gather facts for later evaluation. An expert system merely is a way of making a mechanical interview more reliable and probably more intelligent because it can be more systematic and because it can marshal a higher level of expertise.

Some skilled interviewers prefer to conduct an open-ended interview, having the client simply tell his or her story and applying a legal structure to the facts contained in the story only after the client finishes. Expert systems cannot conduct this kind of interview under the present state of the art. Rather, they must force the client to answer mostly closed-ended questions in a multiple choice or yes/no format. This undoubtedly restricts the flexibility of an interview, possibly suggesting to the client the kinds of answers that may enhance his or her legal position. The system may also fail to deal with a client's reluctance to be candid about sensitive facts.

Although many people would prefer to have a highly skilled lawyer with specialized expertise concentrate on each case, economic reality does not permit it. Under the present legal system, a great many cases, especially those presented to legal clinics and administrative agencies, are screened by applying relatively mechanical criteria. An expert legal diagnostic system of the sort discussed in this Article is well suited to perform such a screening function, making subsequent application of more specialized legal expertise more efficient and focused. In other words, one can view the expert system as a research or preliminary litigation plan for most cases, and a tool in identifying those cases which need to be treated as exceptions. Needless to say, a legal expert system of any type is only as good as the content included by its author.

The remainder of this Article focuses on a particular area of the law: common law theories permitting recovery of damages for wrongful employment termination.

IV. INTERROGATION STRATEGY: HOW TO GET FACTUAL INFORMATION RELATING TO SELECTED ATTRIBUTES

Once one resolves the knowledge representation problem permitting structural relationships to be expressed hierarchically, one still must address an entirely different set of problems in order to build an expert legal diagnostic system. The Introduction explained that WDES asks a series of questions and then provides analysis according to the answers to those questions. Implicit in such a system is a certain interrogation strategy.

Legal analysis involves evaluating facts according to legal doctrine. Recall the battery syllogism in Part II, section 3. The major premise is a legal rule derived from statutory or common law. The minor premise is a characterization of facts related to the particular transaction.⁹¹ The linkage between the two is the middle term.⁹² Diagnosis involves deciding which facts of the case are legally important and simultaneously deciding which legal rules may be applicable (i.e., determining what the middle term is in a series of syllogisms). The process is not unique to lawyers. Physicians do the same thing: "[K]nowledge consists in general and objective diagnostic categories by which the physician sorts the concrete signs and complaints confronting him."⁹³

Diagnosing legal problems involves applying a hierarchy of syllogisms, selecting the current syllogism by picking the middle term. Once the middle term is selected, the interrogator's expertise suggests the major premise (the legal rule) and the interrogator asks the subject whether the minor premise is satisfied. Moving up or down the hierarchy of syllogisms as the interview proceeds is a matter of interrogation strategy. Litigators implicitly apply interrogation strategies when they consider taking a case, or, having taken it, when they develop an initial legal strategy. Counselors apply interrogation strategies as a first step in giving advice. Law students taking examinations and judges deciding cases also do this.

Assuming that knowledge representation problems have been resolved so that the interviewer has a legal framework (a hierarchy of syllogisms) within which to consider facts,⁹⁴ the interviewer must decide which is the best strategy for acquiring factual information regarding the case.⁹⁵ What questions should the interviewer ask and in what order? There are many strategies, no one of which is objectively correct in all circumstances.⁹⁶ One approach is to focus on a known fact that is a link to a particular legal theory⁹⁷ and ask about its unknown features.⁹⁸ If the answers to the questions strengthen the linkage to the

91. To facilitate exposition, the following discussion will refer to a cluster of facts related to a particular transaction as a "case."

92. Meldman, *supra* note 28, at 43 (describing process as matching of terms).

93. E. FREIDSON, PATIENTS' VIEWS OF MEDICAL PRACTICE 176 (1961) (analogies to medical diagnosis especially helpful).

94. See G. BELLOW & B. MOULTON, THE LAWYERING PROCESS 191 (1978) (structuring an interview requires detailed knowledge of the elements of common legal claims and defenses).

95. In other words, the interviewer must decide what minor premises can be proven.

96. G. BELLOW & B. MOULTON, *supra* note 94, at 191 (contrasting "funnel sequence" with "inverted funnel").

97. I.e., the middle term in a syllogism.

98. The "unknown features" may be middle terms in syllogisms whose major prem-

legal theory, further questions, progressively more specific, should be asked. If the follow-up questions weaken the link to the legal theory, the questioner might move to another known fact which has a stronger link to another legal theory.⁹⁹ This has been called the "funnel sequence" in legal interviewing.¹⁰⁰ "The term refers to a procedure of asking the most general or unrestricted question in an area first, and following it with successively more restricted questions. In this way the content is gradually narrowed to the precise objectives."¹⁰¹ A slightly different application of this interrogation strategy is to permit the user to answer an aggregate question if he knows the answer, and otherwise to ask questions at a greater level of detail.

When practitioners interview clients, they ask factual questions and match the answers with a mental checklist of elements derived from their knowledge of case law. Typically, the questions focus on the easiest cases first and evolve toward the more difficult or borderline cases. The process resembles decomposition of a factual problem and classification of its components.

Computer scientists call this a *backward chaining* method of problem solving.¹⁰² One starts with a rule and ascends the hierarchical tree, determining whether the predicates of the rule are satisfied. For example, one might start with the basic rule for breach of contract

"breach__of__contract" if capacity and promise and consideration
and breach.

and work one's way through each of the elements until it is determined whether the rule has been satisfied. Non-legal examples of this strategy are physicians gathering information that will confirm or disprove the most likely diagnosis, and criminal investigators concentrating their information gathering efforts on their prime suspect.

A fundamentally different interrogation strategy is to ask about all the facts in relatively specific terms, and, only after all the facts have been obtained, apply one or more legal rules to see which are satisfied. Computer scientists would call this a *forward chaining* method of problem solving.¹⁰³ For example, a lawyer might ask detailed questions

ises are rules lower on the hierarchy. The approach described in the text is an example of descending the knowledge representation tree.

99. In other words, explore a minor premise pertaining to a different major premise.

100. See G. BELLOW & B. MOULTON, *supra* note 94, at 188.

101. *Id.*

102. Backward chaining is a way of resolving logic programming problems by starting with the ultimate goal and working backward to test antecedents.

103. Forward chaining solves logic programming problems by beginning with facts asserted as true and working forward to determine which goals are satisfied by the facts.

about the way in which employment commenced, performance reviews, treatment by supervisors, documents and oral representations covering the employment relationship, conduct on and off the job, employer behavior preceding the termination, and the specifics of the termination itself. Or a physician might take vital signs and ask about diet, exercise, sleep patterns, and other possible symptoms before considering what pathology is indicated.¹⁰⁴

In addition to deciding which topics to cover and in what order, a skillful legal interviewer also considers how questions should be framed. Three question-framing issues are important: (1) what words should be used so that the respondent understands the question in the same way that the interviewer intends it to be understood? (2) should a particular question be asked in such a way that the respondent is restricted to choosing his answer from a prearranged list of responses (closed question), or, should it require him to answer in his own words (open question)? and (3) should objectives be approached directly or indirectly?¹⁰⁵ Some commentators express concern about the distorting tendency of leading questions, but others believe leading questions are helpful in developing information fully.¹⁰⁶ Closed questions are more useful when the objective is classification.¹⁰⁷

These interrogation strategy issues will be revisited later in the context of a wrongful dismissal system design. First, it is appropriate to start building that context by describing the legal principles of wrongful dismissal, i.e., to describe the top-level concepts in a knowledge representation system for wrongful dismissal.

V. WRONGFUL DISMISSAL LEGAL CONCEPTS

A. *Legal Overview*

About forty states have recognized at least one of three wrongful dismissal theories, sometimes referred to as exceptions to the "Employment at Will" rule.¹⁰⁸

The first is the Public Policy Tort theory.¹⁰⁹ It permits terminated employees to recover damages resulting from their terminations when they can show that a termination jeopardized realization of a public

104. The most obvious example of this forward chaining strategy in medicine is requiring a patient to fill out a check list before meeting with a diagnosing physician.

105. G. BELLOW & B. MOULTON, *supra* note 94, at 198.

106. *Id.*

107. *Id.*

108. See H. PERRITT, *EMPLOYEE DISMISSAL LAW AND PRACTICE* §§ 1.1-.17 (2d ed. 1987).

109. See generally *id.* §§ 5.1-.21.

policy reflected in a state or federal constitution, statute, or administrative regulation, or in a formal code of conduct for a profession. Early cases accepting this theory were *Nees v. Hocks*¹¹⁰ and *Sheets v. Teddy's Frosted Foods, Inc.*¹¹¹

This Public Policy Tort theory requires the plaintiff to plead and prove the following elements: (1) the existence of a clear public policy, manifested in a state or federal constitution, statute, or administrative regulation, or in the common law; (2) that dismissing employees under circumstances like those involved in the plaintiff's dismissal would jeopardize the public policy; (3) that the plaintiff's dismissal was motivated by conduct related to the public policy; and (4) that the employer lacked overriding legitimate business justification for the dismissal.¹¹²

The second is the Implied-in-Fact Contract theory, permitting a terminated employee to recover damages when she can prove breach of an implied-in-fact contract.¹¹³ Under this theory, employees are permitted to establish a contract right not to be terminated at will, based on informal employer promises of employment security, such as those made orally at the time of hire, or those contained in employee handbooks or personnel policies. The leading case recognizing this theory is *Toussaint v. Blue Cross & Blue Shield*.¹¹⁴

This Implied-in-Fact Contract theory requires a plaintiff to plead and prove the following elements: (1) the employer made a promise of employment security; (2) there was a validation device for the promise, in the form of a bargained-for exchange, detrimental reliance, or otherwise; (3) the employer breached the promise by dismissing the employee; and (4) the employee suffered damages.¹¹⁵

The third is the Implied Covenant of Good Faith and Fair Dealing theory, a contract theory with tort aspects.¹¹⁶ It permits dismissed employees to recover damages for breach of an "implied covenant of good faith and fair dealing." It was one of the earliest exceptions to the employment at will rule, recognized in *Petermann v. Local 396, Interna-*

110. 272 Or. 210, 536 P.2d 512 (1975).

111. 179 Conn. 471, 427 A.2d 385 (1980).

112. Obviously, one could express the elements of the Public Policy Tort differently. *see. e.g., Grzyb v. Evans*, 700 S.W.2d 399 (Ky. 1985); this is why knowledge representation is so challenging.

113. *See* H. PERRITT, *supra* note 108, §§ 4.1, .6-.24.

114. 408 Mich. 579, 292 N.W.2d 880 (1980).

115. The knowledge representation problems are less serious with respect to the Implied-in-Fact Contract theory than with respect to the Public Policy Tort theory because there is wide agreement on the elements of common law breach of contract.

116. *See* H. PERRITT, *supra* note 108, §§ 4.11, .23.

tional Brotherhood of Teamsters,¹¹⁷ and embraced in both *Monge v. Beebe Rubber Co.*¹¹⁸ and *Fortune v. National Cash Register Co.*¹¹⁹ The Implied Covenant theory has declined in importance as courts have developed Public Policy Tort¹²⁰ and Implied-in-Fact Contract¹²¹ theories. The weaknesses of the Implied Covenant theory are that it leaves too much to the jury,¹²² and that it potentially duplicates the Public Policy Tort concept.¹²³ Nevertheless, few courts have repudiated the theory entirely because it may permit relief in apparently deserving cases that do not fit the evolving requirements for Public Policy Tort or Implied-in-Fact Contract theories. Under the broadest view of the doctrine, a dismissed employee need only show the existence of an employment relationship, the termination of the employment, and that some aspect of the termination was unfair or in bad faith.¹²⁴ Upon such a showing, a jury would be entitled to decide, with only the most general instructions, whether the termination was fair and in good faith.¹²⁵

This part of the Article applies the knowledge representation and interrogation strategy discussions to wrongful dismissal expert system design. The first section addresses knowledge representation and the second section addresses interrogation strategy.

B. *Wrongful Dismissal Knowledge Representation Issues*

The objectives of a wrongful dismissal diagnostic system are to obtain factual information about a potential case and to evaluate that factual information according to a family of legal doctrines. There are several ways in which one can express the result of the first step. One can conceive of the factual information as a record in a database, in which there is a field for each legally relevant fact. The more mathematically

117. 174 Cal. App. 2d 184, 344 P.2d 25 (1959).

118. 114 N.H. 130, 133, 316 A.2d 549, 551 (1974).

119. 373 Mass. 96, 104, 364 N.E.2d 1251, 1257 (1977).

120. See *supra* notes 109-12 and accompanying text.

121. See *supra* notes 113-15 and accompanying text.

122. See *Thompson v. St. Regis Paper Co.*, 102 Wash. 2d 219, 227, 685 P.2d 1081, 1086 (1984) (adopting the Implied-in-Fact Contract theory and the Public Policy Tort theory, but refusing to adopt the Implied Covenant theory because its bad faith concept is "amorphous" and because it might be internally inconsistent with actual conduct or promises).

123. See *Brockmeyer v. Dun & Bradstreet*, 113 Wis. 2d 561, 573, 335 N.W.2d 834, 840 (1983) (no breach of implied covenant unless clear public policy violated by discharge); H. PERRITT, *supra* note 108, §§ 1.15-16.

124. See H. PERRITT, *supra* note 108, §§ 4.11, .23.

125. The Implied Covenant theory represents a substantial departure from analytic logic using specific rule terms. In essence the jury decides the case according to only the most general principles.

inclined could conceive of the factual information as a vector in which each element represents a legally relevant fact. Or, one could view the factual information as simply a list.

It is desirable to impose an appropriate structure on the facts relating to a particular case because such a structure facilitates analysis in step two.

1. WDES Knowledge Representation

A high degree of substantive structure is not essential; WDES represents facts about a case simply as a list of numbers and choices, e.g.,

12:52:17.17
Tue 8 Jul 1986

T
1,G;
3,E;
9,D;
10,B;
13,A;
C
1,B;
14,E;
S
1,B;
4,B;
5,A;
6,A;
7,A;
8,A;
9,B;

In this representation, facts are clustered by general legal category. The single letter preceding a set of entries indicates the category: T for tort, C for contract, and S for statute. The substance of the fact is indicated by a number and a letter. The number indicates the position of the question in a separate question file. The letter corresponds to the choice the user selected in response to the question. In the example, the first entry in the tort category (1,G;) indicates that the user selected choice G in response to the first tort question. The second entry says that the user selected choice E to tort question number 3. Tort question 2 was not asked because its asking criteria were not met. Similarly, the second entry in the statutory category (4,B;) indicates that the user selected choice B of the fourth question in the statutory file.

This representation system is usable, but its meaning depends on the position of elements in another file, both questions and response choices. The list of facts about a case has no meaning independent of

the order in which the questions were processed or the content of the choices presented to the user. This dependency makes it cumbersome to change evaluation rules or questions because each affects the other. Inserting one question requires that all rules for that category be changed because the positions of all the questions change.

2. Prolog Knowledge Representation for Wrongful Dismissal Implied-in-Fact Contract Claims

Two types of factual information can be distinguished: facts relating to the existence of employer duty and facts relating to the possible employer breach of duty. Many duties do not depend on the facts of the employment relationship. The duties not to discriminate on the basis of race, sex, religion, national origin, or age are obvious examples. Duties arising from contract, however, do depend on the facts of the employment relationship. Accordingly, the knowledge representation system should permit facts relating to contractual duties to be represented.

In the employment context, promises of employment security have two legally significant characteristics: the form of the promise and the content of the promise. The five *forms* are an explicit written promise to a specific employee, an oral promise, a promise contained in a handbook, a promise contained in formal employer policies not published to the work force at large, and a "promise" inferred from a course of conduct.¹²⁶ The four categories of promise *content* are a promise to continue employment for a specific time period, a promise to dismiss only for good cause, a promise to dismiss only for certain reasons, and a promise to dismiss only after following certain procedures.¹²⁷

The consideration element of the Implied-in-Fact Contract theory is relatively easy to represent. Consideration exists if a return promise has been given by the employee, if the employee has conferred a benefit on the employer, or if the employee has relied detrimentally on the employer's promise. The detrimental reliance mode of consideration is the most complicated of the three. Detrimental reliance can be consideration under two legal theories: bargained-for detriment and promissory estoppel.¹²⁸ Bargained-for detriment requires that the employer make the promise for the purpose of inducing the detrimental conduct, that the employee know about the promise, that the employee engage in conduct that amounts to detriment, and that the motivation for the em-

126. See H. PERRITT, *supra* note 108, § 4.9.

127. See *id.* § 4.22.

128. See *id.* §§ 4.12-.17.

ployee's conduct be the promise.¹²⁹

The promissory estoppel form of detrimental reliance is slightly different from bargained-for detriment in that the employer's purpose for making the promise need not be inducing the detriment. Rather, it only is necessary that the employer realize that the promise might induce detriment, and that the employee's conduct in reliance on the promise be reasonable.¹³⁰

The following is a Turbo Prolog representation of the material facts relating to a contractual duty:

contract(possible__forms, possible__contents, consideration)

The arguments can take on the following values:

possible__forms:	written
	oral
	handbook
	formal__policies
	practices
possible__contents:	definite__term
	cause
	specific__reasons
	procedures
consideration:	bargained__for__exchange
	return__promise
	money
	property
	promissory__estoppel

The "values" themselves can be defined to encompass arguments. It is appropriate, for example, to represent "detrimental__reliance" in terms of certain attributes, and promissory estoppel in terms of similar, but slightly different, attributes:

bargained__for__exchange(knowledge, employer__purpose, employee__motive, detriment(description))
 promissory__estoppel(knowledge, employer__should__have__known, employee__purpose, reliance__reasonable, detriment(description)).

The predicate "knowledge" is true if the employee knew of an employer representation. The predicate "detriment(description)" has, in its argument, a phrase describing what the employee gave up. The predicate "employer__purpose" is true if the employer made the representation for the purpose of inducing the employee to give up what the phrase describes. The predicate "employee__motive" is true if, because

129. *See id.* § 4.13.

130. *See id.* §§ 4.14-.16.

of the employer's representation, the employee gave up what the phrase describes. Other values for form and content similarly could be defined to encompass arguments, permitting a more detailed representation of the employer assurances.

The facts of the termination also must be represented in a useful structure, permitting efficient rule application under all of the theories. The knowledge representation structure for the facts of the termination should be sufficiently general to relate to Public Policy Tort, Implied-in-Fact Contract, and Implied Covenant analyses. Otherwise, the system will be required to ask about the facts of the termination several times.

At the most general level, four aspects of the termination should be represented:

termination(proffered__reason, suspected__reason, actual__procedure, actual__manner).

The content of these four arguments is apparent from the following disaggregation:¹³¹

proffered__reason:	no__economic__need performance conduct__on conduct__off incompat__supervisor incompat__fellow some__other(description) no__reason
suspected__reason:	no__economic__need performance conduct__on conduct__off incompat__supervisor incompat__fellow some__other(description) no__reason
actual__procedure:	warnings review__personnel review__higher grievance severance__pay release
actual__manner:	physical__violence unusual__abuse dissemination

131. The elements could be represented as a list, but Prolog permits multiple instances of the same predicate; therefore, a list representation is not necessary to accommodate the likely circumstance that more than one of the attributes will be present in a real-world termination.

On-the-job conduct and off-the-job conduct should be disaggregated as follows:

conduct__on:	refused__orders
	internal__protest
	theft
	fighting
	substance__use
conduct__off:	political__expression
	association
	lifestyle

Certain of the arguments to these predicates also should be disaggregated further:

political__expression:	campaign
	public__issue
	voting
association:	membership
	leadership
	informal
lifestyle:	marital__status
	drugs
	alcohol
	crime
	sexual__orientation

The knowledge representation system chosen for the facts of the case largely dictates the way the rules can be written. The rules will be legal doctrines written in terms of the labels ascribed to particular facts.

3. Prolog Knowledge Representation for Public Policy Tort Theory

The Public Policy Tort theory imposes a duty on employers not to retaliate against employees for certain kinds of conduct that promote public policy.¹³² The basic concepts are closely related to statutory employee protection. Accordingly, the knowledge representation structure for the Public Policy Tort theory also will accommodate all forms of statutory employment termination theories, including unfair labor practices and statutory discrimination.

The fundamental challenge in designing an appropriate knowledge representation structure for the Public Policy Tort theory is to design a collectively exhaustive and mutually exclusive hierarchy for the answers to the following questions. If the employee protested or otherwise ob-

132. See *supra* notes 110-12 and accompanying text.

jected to the employer's conduct and was fired for that reason,¹³³ (1) who was jeopardized by the employer's conduct? (2) what harm to the persons jeopardized could result? and (3) does the law suggest protection of those persons from that harm?¹³⁴ Or, if the employee was fired for other conduct not involving controversy over employer policies or practices,¹³⁵ (1) what societal interests were served by the conduct for which the employee was terminated?¹³⁶ (2) what personal employee interests were served by the employee's conduct for which he was terminated?¹³⁷ and (3) does the law recognize the societal and personal interests thus implicated?¹³⁸

One family of facts to be acquired relates to the conduct the employee engaged in. The second family of facts relates to the type of legal rights involved. Legal rights may relate either directly or indirectly to the employee's conduct. A direct relationship between rights and conduct is exemplified by explicit statutory protections for employee protest of discrimination,¹³⁹ and the explicit statutory grant of the right to engage in concerted conduct relating to terms and conditions of employment.¹⁴⁰ An indirect relationship between rights and conduct frequently exists when the employee's conduct is "whistleblowing."

The law does not address the employee protest or the reporting of employer misconduct directly; rather, the law addresses the employer misconduct itself. The employee's conduct serves to aid that legal policy, so the knowledge representation system for the Public Policy Tort theory should divide employee conduct into types directly protected by law and types protesting or otherwise resisting¹⁴¹ employer action.

As to employee conduct that may be protected directly, two basic categories of employee conduct are of potential legal significance: con-

133. This branch of the inquiry is characterized as potentially involving an "internal public policy tort." See H. PERRITT, *supra* note 108, §§ 5.11-13.

134. An example would be the dismissal of an employee for objecting to unsanitary conditions in a food processing plant. Those jeopardized would be consumers of the food produced. The harm would be injury to their health. The law protects consumers against unsafe food products. Federal Food, Drug and Cosmetic Act, 21 U.S.C. §§ 301-392 (1982 & Supp. III 1985).

135. This branch of the inquiry is characterized as potentially involving an "external public policy tort." See H. PERRITT, *supra* note 108, §§ 5.9-11.

136. Jury service would be a clear example of employee conduct serving societal interests.

137. If an employee is fired for filing a workers' compensation claim, the conduct for which he was fired serves his interests in receiving compensation for workplace injury.

138. The answer is clearly yes for both jury service and workers' compensation claims.

139. See Title VII of the Civil Rights Act of 1964, § 704, 42 U.S.C. § 2000e-3 (1982).

140. See National Labor Relations Act, § 7, 29 U.S.C. § 157 (1982).

141. Sometimes the employee refuses employer orders, rather than protesting or reporting employer activities.

duct off the job (external), and conduct on the job (internal). Accordingly, the following structure is appropriate to represent employee conduct:

employee__conduct(on__off__possibilities, direct__indirect).

The arguments can take the following values:

on__off__possibilities:	external internal
direct__indirect:	directly__protected protest

Responses offered for "conduct-off-the-job" (external) should be classified by categories associated with public policies. To this end the "external" argument should be capable of taking on certain values itself, reflecting socially useful service,¹⁴² political expression, political campaign activity, associational activity, and lifestyle choices. Each of the values may take on additional values, as the following hierarchy shows.

external(type)	
type:	socially__useful political__expression association life__style
socially__useful:	jury__service charitable
political__expression:	political__campaign public__issue voting
association:	membership leadership informal
life__style:	marital__status sexual__orientation drugs alcohol

On-the-job conduct associated with public policies can be sub-classified into three categories: reporting employer practices to government agencies, protesting employer practices to supervising personnel of the employer, and refusing to comply with employer orders.

142. The most obvious example, well-recognized in Public Policy Tort cases, is jury service.

internal(type)

type: reported__agency
reported__press
reported__internally
refused__orders

A common element of all four types of internal employee conduct is some type of employer activity to which the employee objected. Exploration of employer conduct identifies the factors that may be linked to public policy. One possibility is that the employer's practices violated a statute or administrative regulation ("violated__law"). Another possibility is that the practices harmed the public even though they did not violate a specific provision of law ("harmed__public"):

employer__conduct(type)

type: violated__law
harmed__public

The Public Policy Tort theory case law protects protesting employees only when they can relate their protest to some clear statement of public policy.¹⁴³ Evaluation of the clarity of the public policy asserted depends on the class protected by the asserted policy, enforcement mechanisms aside from the employee protest, and the degree to which the policy is articulated explicitly in a constitution, statute, or regulation. To a substantial degree, these facets of the analysis apply to both the "violated__law" and "harmed__public" categories of employer conduct. It is appropriate to create a knowledge representation structure which records these facets independently of the value of the type of conduct:

policy(source, protected__class, agency, enforcement)

source: constitution
statute
regulation
common__law
professional ethics
community values
protected__class: public__at__large
employees
investors
creditors
employing__entity
agency: state__administrative
federal__administrative
prosecutor
civil__courts

143. See *supra* notes 110-11 and accompanying text.

	press
	private__association
enforcement:	administrative
	criminal
	civil__suit

It is difficult to develop a collectively exhaustive list of values for these arguments. An ideal knowledge representation system would be dynamic in the sense that it would permit values to be added when a user has a fact pattern that does not fit neatly into the predefined values. An alternative is to permit specifics to be recorded in natural language phrases, as would be appropriate with a constitutional, statutory, or regulatory citation, or with an agency name.

If "internal__protest" is involved, it may be important to determine how the protest was made: whether the employee followed the chain of command, whether the employer responded by promising to undertake appropriate investigation or corrective measures, and whether the employee neglected his or her job responsibilities in making the protest:

```
internal__protest (manner)
  manner(chain__of__command, employer__response, job__
    neglect)144
```

The absence-of-justification element of the Public Policy Tort theory involves two types of possible employer justification: justification involving performance or conduct issues unrelated to the asserted public policy, and justifications involving not only public policy, but also involving one or more overriding employer interests. The first branch of the absence-of-justification analysis involves the same factual matters already covered in the knowledge representation discussion for termination. The second branch should be addressed by recording whether the employer is subject to any statutory or regulatory duty to make its own policy determinations about the practices objected to by the employee.¹⁴⁵

The resulting knowledge representation structure for the Public Policy Tort theory is obviously hierarchical, an advantage for legal knowledge representation systems discussed in Part III.

144. Each of the arguments for manner would have the same value "yes" or "no" or, to say the same thing differently, "true" or "false."

145. For example, airlines are required to implement various air crew training and certification and aircraft maintenance programs approved in advance by the Federal Aviation Administration. See Federal Aviation Act of 1958, 49 U.S.C. app. §§ 1421-1432 (1982 & Supp. III 1985).

C. *Applying Interrogation Strategies in Wrongful Dismissal Expert System Design*

A legal analyst designs a diagnostic expert system by considering three related questions. First, what are the appropriate rules? Second, in what form should factual information be represented so the rules can be applied? And third, how should factual questions be presented to the user?¹⁴⁶ This section considers the third question in detail with respect to each of the three wrongful dismissal theories, thereby touching on the first question as well.

The major distinction between the expert system discussed in this Article and other simpler programs, such as those written by the author's seminar students,¹⁴⁷ is that this expert system breaks the links between interrogation and analysis and between analysis and advice presentation.¹⁴⁸ This is not to say that the interrogation is not intelligent; the user is not asked about the details of possible employer promises if the user has said the employer made no promise.¹⁴⁹ But, as is explained in this section, questioning is not necessarily aborted as soon as a single aspect of a legal theory is satisfied by the answer to a question.¹⁵⁰

Before considering the rules and questions for the Implied-in-Fact Contract and Public Policy Tort theories, three preliminary knowledge representation and interrogation strategy points should be made. First, ultimately the wrongful dismissal legal doctrines (and therefore the expert system rules) involve identifying an employer duty and then examining the facts of the termination to see if the duty was breached. In the Public Policy Tort and Implied Covenant theories, the duty is externally defined. In the Implied-in-Fact Contract theory, the duty derives from facts about the employer's conduct. Accordingly, the knowledge representation structure for the Implied-in-Fact Contract theory is much more dependent on user queries than the structure for other theories.

146. The choices made with respect to knowledge representation structure dictate the form in which user answers will be accepted and recorded.

147. The following small expert systems were written in Turbo Prolog by students in the Fall 1986 "Computer Science and the Legal Process" seminar at the Villanova University School of Law: Title VII race discrimination case evaluator; patent validity evaluator; § 1983 police brutality liability evaluator; search-and-seizure evaluator.

148. Compare Appendices A and B, *infra*, (question presentations) with Appendix C, *infra*, (advice presentation).

149. If the answer to question 1 in Appendix A is negative, the system does not ask questions 2-5. Similarly, if the answer to question 6 is negative, the system does not ask questions 7-10.

150. As Appendix A shows, the user is asked about oral representations, *see* questions 6-10, even though the user already has said that a written agreement existed, *see* answer to question 1.

Second, outcome-determinative facts related to the breach question may be similar under more than one theory. As the following discussion indicates, it is efficient to develop certain factual information relating to the termination of the employment first, before asking questions related to particular theories. These facts regarding the termination then can be used more than once to evaluate the breach question under various theories.

Third, interrogation is essentially bottomless. Any practical question drafted in advance of knowing the answer requires the person to whom the question is presented to draw certain conclusions. A particularly clear example is a question that might be presented in connection with the bargain theory of contract validation: "Is it reasonable to infer that the employer's purpose in making the promise was to induce employees to rely on the promise by suffering a detriment of the type suffered by this employee?" One always could improve on the question by breaking it down into more specific fact components, theoretically permitting the computer to apply a rule to decide if the inference is reasonable.

One of the recurring issues in picking an interrogation strategy is whether a complete set of facts should be obtained before legal analysis occurs, or whether only enough facts should be obtained to determine if a legal theory is applicable.¹⁵¹ For example, if the user says that the employee gave a return promise for the employer's promise of employment security, the consideration element is satisfied. Should the program go on to ask if there was detrimental reliance, an alternative way of satisfying the consideration element?¹⁵² Should the program ask about the factual prerequisites for promissory estoppel even though the user has indicated that the requirements for bargained-for detriment are present?¹⁵³

1. Termination: Employee Conduct and Employer Motive

Developing appropriate interrogation strategies for the termination facts is challenging, mainly because the answers will be used to evaluate fundamentally different legal theories. Considerable thought must be directed to deciding what questions to ask about the conduct and how to represent the answers in machine processable form. Deciding what

151. Computer scientists refer to the first as *forward chaining* and the second as *backward chaining*. See *supra* notes 102-04 and accompanying text. The Pascal version of the expert system uses forward chaining. The Prolog version uses backward chaining.

152. The current Prolog system does this. See Appendix A, *infra*, answer to question 12, and questions 13-28.

153. The current Prolog system does this. See Appendix A, *infra*, answers to questions 24-25, and questions 26-27.

facts to obtain to evaluate a possible breach of contract is relatively easy; a breach occurs when the employer's conduct does not conform to the promise made. But the facts obtained regarding the termination also must permit the possible applicability of the Public Policy Tort to be evaluated. As will become clear, this is not a trivial task.

The universe of facts about the termination can be subdivided into two parts: those relating to the employer's conduct and state of mind, and those relating to the employee's conduct. Eliciting material facts about employer conduct involves choosing among three basic approaches. Evaluating the approaches involves tradeoffs between knowledge representation objectives and interrogation strategy objectives. The way a human interviewer might get into the termination question, e.g., "How did the employer communicate the decision to terminate and what was the employer's motivation?" is not feasible for the expert system because of the natural language problem. The program could ask such a question and receive a free-form natural language answer, but it would not be able to process the answer according to the terms of its rules or to match it against the content of a promise.

One feasible approach would ask questions matching the duty categories, e.g., "Did the employer's decision to terminate violate its promise to terminate only for good cause?" and "Did the employer's decision to terminate violate public policy?" This can be called the "duty-driven" approach. This approach, however, requires the user to draw ultimate factual or legal conclusions, and fails to ascertain factual detail about what the employer actually did.

A second approach is to ask a series of questions, each of which addresses a type of employer conduct that frequently occurs. Then, affirmative answers to these questions can be matched through rules with the duties already identified. This can be called the "exhaustive" approach. The number of questions asked in an exhaustive approach can be reduced by starting with a small number of general questions each relating to an important variable in termination decisions, such as time, motivation, procedures followed, and method of communication. Each of these questions would lead to more specific factual questions depending on the answers to the general questions.¹⁵⁴ For example, the first question might be, "Did the employer assert that poor performance was one of the reasons for the decision to dismiss?" Only if the answer to this question is affirmative would the next question be asked: "Did the

154. This is an example of the "funnel strategy." See *supra* notes 96-101 and accompanying text. Appendix B, *infra*, shows the results of termination questioning by the present Prolog system.

employer say that the employee performed poorly because of customer dissatisfaction?"

Next, the interviewee should be asked whether there is documentation of the employer's evaluation of the employee performance before the termination. If the answer is yes, the interviewee should be asked to characterize the evaluation as favorable or unfavorable, perhaps on a five or ten point scale. If any aspect of the evaluation had been unfavorable, the interviewee should be asked whether the evaluations related to conduct or performance, and whether the employee received warnings or other rehabilitative measures.

Some interrogation strategy issues depend on the interrogator's understanding of legal doctrine. If the user has identified more than one type of promise content, for example, a promise to dismiss only after following certain procedures and a promise to dismiss only for just cause, then the program should evaluate whether the employer's conduct conformed to each type of promise.

But should breach also be evaluated with respect to each different *form* of promise? For example, if the employer made oral assurances that dismissal would be only for just cause, and also had a just cause dismissal provision in an employee handbook, would the permissible dismissals for just cause be independent? Ordinarily, it would not be legally significant that the employer made two promises to dismiss only for just cause. But timing problems may defeat consideration for one form of promise but not the other; therefore, it may be important to determine whether employer conduct conformed to each instance of just cause promise even though both promises had contained the same general content. In real cases, the promise content may differ slightly between the oral assurance and the handbook or formal policy, yet both can be correctly characterized as just cause procedural promises. In such cases, it would be important to preserve the user input on termination questions relating to each of the promises.

The following are the termination questions and rules developed according to the discussion.¹⁵⁵

```
breach if employer__conduct
      and employee__conduct.
employer__conduct if reason__given
      and procedures__used
      and manner.
reason__given if ask(no__economic__need) or
```

155. To facilitate readability, certain parts of the clauses as they appear in the Prolog program are omitted. The omitted parts control the exact text of the questions and the way answers are evaluated to determine if they are affirmative or negative.

```

ask(performance) or
ask(conduct__on__job) or
ask(conduct__off__job) or
ask(incompatibility__supervisor) or
ask(incompatibility__fellow__employees) or
ask(some__other__reason) or
ask(no__reason).
procedures__used if ask(warnings) or
ask(reviewed__by__personnel__dept) or
ask(reviewed__by__higher__authority) or
ask(internal__grievance) or
ask(severance__pay) or
ask(release__or__settlement).
manner if not(confinement) and
not(physical__violence) and
not(unusually__abusive).

```

The discussion on interrogation strategy in Part IV noted that closed-form questions are favored in most diagnostic situations. Computers ask closed-form questions by requiring yes/no or multiple choice responses. This has the advantage in Prolog of ensuring that the user's answer triggers a predicate as true or false. A few questions, however, can permit free-form natural language responses, especially to elaborate a yes/no or multiple choice answer. For example, if the user says the employer asserted that on-the-job conduct was the reason for the termination, the program asks the user to describe the type of conduct objected to by the employer. The program records a sentence describing the conduct, permitting subsequent questions or rules to retrieve the natural language phrase. A cumulative file of natural language entries can be maintained to permit periodic updating of the rules and questions in the program.

2. Implied-in-Fact Contract

Framing questions for the Implied-in-Fact Contract theory similarly presents several interrogation strategy issues. Some of the interrogation strategy choices reflect the author's substantive understanding of the legal theory. For example, the implied-in-fact contract part of the expert system begins by asking the user about several forms of employer promise, such as oral assurances, employee handbooks, formal personnel policies, and long-standing practices. It also asks about the content of the promise: whether the employer promised to dismiss only for cause, promised to dismiss only after following certain procedures, or promised to employ for a particular period of time. The program could ask about the content of all the forms of promise as a group, or it could ask all of the content questions about each individual form of promise.

The latter approach is preferable if the purpose of the program is understood to be collecting complete factual information for a later supplementary analysis by an attorney rather than for the purpose of deciding the case. One form of promise might be less likely to be enforced than another, in which case it would be important to know the content of each independent form of promise.

Choices must be made about the order of questioning. For example, the interrogator could begin asking about the different forms of the promise and then change the focus of questioning to the content as soon as one of the four forms had been determined to exist. For example:

Did the employer make any oral statements about the duration of employment, or the conditions under which it could be terminated?

(If yes answer to previous question)

Did the employer state that employment would be terminated only for just cause?

Did the employer state that employee would be terminated only after certain procedures were followed?

Alternatively, because of the possibility that more than one form of promise would be involved and that more than one form would have the same content, the interrogator could ask about each of the four forms of promise before asking about the content of any one of them. For example:

Did the employer make any oral statements about the duration of employment, or the conditions under which it could be terminated?

Did the employer have a handbook distributed to employees?

Did the employer have a formal personnel policy, regardless of how broadly it was distributed?

Did the employer have a long-standing practice of terminating only for certain reasons or only after certain procedures were followed?

(If yes answer to any of previous four questions)

Did the [oral statement/handbook/formal policy/practice] contemplate termination only for just cause?

Did the [oral statement/handbook/formal policy/practice] contemplate termination only after certain procedures were followed?¹⁵⁶

Similarly, the interrogator could prompt the interviewee with respect to each type of promise content only until one of the categories was found to be present in the factual situation. Alternatively, the interrogator could ask about all four categories of promise content.¹⁵⁷ Be-

156. See Appendix A, *infra*, for an actual question-and-answer session on facts material to an implied-in-fact contract.

157. If more than one form of promise is present, the interrogator similarly could ask about all the content categories with respect to each form of promise.

cause of the likelihood that an employer would have made promises in several forms, and because the content of these different forms of promises could be different, the best interrogation strategy is to ask about each one of them.¹⁵⁸

The same dilemma is presented when the consideration questions are framed. Should the system ask the user about consideration in connection with each separate promise?¹⁵⁹ Or, should it treat more than one form of promise as establishing an integral part of the employer offer? The latter approach is more consistent with the theoretical view of consideration: that only one consideration is necessary to support several promises.¹⁶⁰ The former approach is preferable to preserve the specific information given by the user for later analysis by counsel. This system's question and answer dialogue for the Implied-in-Fact Contract theory is provided in Appendix A.

3. Public Policy Tort

The Public Policy Tort theory imposes a duty on employers not to retaliate against employees for certain kinds of conduct that promote public policy. At the threshold, the expert system designer must decide whether to proceed top down, beginning with duty as with the Implied-in-Fact Contract theory, or to begin elsewhere. If one starts with duty, the program requires less from the user because the program itself knows the laws which might support a public policy claim. But this requires the programmer to translate almost all protective legislation into rules because of the flexibility of the Public Policy Tort theory. An alternative approach, resulting in a smaller number of rules, would start with the factual information recorded in the termination part of the knowledge representation structure: the conduct the employee engaged in and the nature of the employer's conduct and motivation. Then the program would ask for certain additional information pertinent to eval-

158. In other words, one should use a forward chaining control strategy.

159. The present version of the Prolog system does this. Questions 22 and 28 of Appendix A relate to consideration for an oral promise to dismiss only for cause; questions 23-27 relate to consideration for a written agreement to employment for a specific term.

160. "A single and undivided consideration may be bargained for and given as the agreed equivalent of one promise or of two promises or of many promises."

Thus, there is no analytical reason why an employee's promise to render services, or his actual rendition of services over time, may not support an employer's promise both to pay a particular wage (for example) and to refrain from arbitrary dismissal.

Pugh v. See's Candies, Inc., 116 Cal. App. 3d 311, 325-26, 171 Cal. Rptr. 917, 925 (1981) (citation omitted) (quoting 1 A. CORBIN, CORBIN ON CONTRACTS § 125, at 535 (1963)); see also A. CORBIN, *supra*, § 125, at 535 ("The fact that there are many promises given in exchange for the one consideration does not make it insufficient as to any of them.").

uation of the Public Policy Tort theory. First is the concept of an employer retaliatory motive:

retaliation if ask("Did the employer object to the employee's conduct?") and employee__conduct.

Two basic categories of employee conduct are of potential legal significance: conduct-off-the-job (external) and conduct-on-the-job (internal). So, the user should be asked a series of questions directed at developing components of the Public Policy Tort theory knowledge representation structure. Information already obtained in response to questions about the termination would not be asked again.

A common element of all three types of internal employee conduct is some type of employer conduct to which the employee objected. The termination knowledge representation structure accordingly identifies the objectionable employer conduct and separately identifies the subcategory of internal employee conduct involved.

Exploration of employer conduct identifies the factors that may be linked to public policy. One possibility is that the employer's practices violated a statute or administrative regulation ("violated__law"). Another possibility is that the practices harmed the public even though they did not violate a specific law ("harmed__public"). At this point, the user should be asked to identify by name or citation the statute or administrative regulation the employer was thought to have violated ("cite"), the class of persons protected by the cited statute or regulation ("protected__class"), the name of the agency with enforcement responsibility ("agency"), and the means of enforcement contemplated by the statute or administrative regulation ("enforcement__scheme").¹⁶¹

employer__conduct if violated__law or harmed__public or other.
violated__law if protected__class and cite and agency and enforcement__scheme.
harmed__public if protected__class and cite and agency and enforcement__scheme.
other if ask(free__form).

As a follow-up to the enforcement scheme question, it should be determined whether the employee can make a plausible argument that the regulatory scheme implicated by the employee's conduct depended to some degree on employer reports to an enforcement agency. The major difficulty with this line of questioning is that it asks the user to engage in a fairly sophisticated form of legal analysis. A fundamentally different way of structuring the program would be to omit these questions and

161. This information is important in deciding whether an implied private right of action may exist for employer retaliation.

present them to the lawyer as a part of the advice and analysis produced by the program.

If "internal__protest" is involved, questions should be asked as to how the protest was made. It may be important to determine whether the employee followed the chain of command, whether the employer responded by promising to undertake appropriate investigation or corrective measures, and whether the employee neglected his or her job responsibilities in making the protest:

internal__protest if chain__of__command and employer__response
and job__neglect.

The final subcategory of internal, or on-the-job, conduct is an employee refusal to obey orders. As to this subcategory, the interviewee should be asked initially whether compliance with the orders would have caused the employee to engage in illegal conduct. If the answer to this question is yes, then it should be determined whether the conduct would have been criminal:

refused__orders if employee__conduct__illegal.

The absence-of-justification element of the Public Policy Tort theory involves two types of possible employer justification: justification involving performance or conduct issues unrelated to the asserted public policy, and justification involving the public policy and also involving overriding employer interest. The first branch of the absence-of-justification analysis involves the same factual matters already covered in connection with breach of an Implied-in-Fact Contract theory. Accordingly, those questions need not be asked again. Regarding the second branch of the absence-of-justification analysis, the interviewee should be asked whether the employer is subject to any statutory or regulatory duty to make its own policy determinations about the practices objected to by the employee.

employer__asserted__motive if reason__given¹⁶² or loyalty or overriding__interests.

An obvious difficulty with questions such as these is that they can be answered only by applying a certain degree of legal knowledge and sophistication. If the expert system is used by a client, the user may not know the answers to the questions. Accordingly, the system should permit the user to answer the questions with an "unknown" or "do not understand" response. The analytical part of the system would then

162. This is the same "reason__given" predicate used in the breach of contract analysis.

focus on the facts relating to questions which generated indefinite responses, and would provide advice as to how answers could be found.

D. *Manner for Presenting Advice and Analysis*

Three applications for a legal expert system can be envisioned: guided analysis, parallel analysis, and substitute analysis.¹⁶³ The system discussed in this Article is a guided analysis system. It collects client-specific factual information, and provides advice for a lawyer on how to conduct a more sophisticated analysis based on rules generated by someone with expertise in the subject matter.

Many other expert systems accomplish "parallel analysis." They apply the rules and provide an answer, perhaps giving relatively little information about the steps connecting the fact information to conclusions. "Substitute analysis" systems use rules or statistical information to connect facts with conclusions, perhaps with little regard to legal doctrine or norms. An example of such a system would be one which used statistical studies of what judges actually do to predict the appropriate sentence for criminal behavior.¹⁶⁴

As noted in the introduction to Part V of this Article, the fundamental choices in the design of a wrongful dismissal expert system relate to the knowledge representation structure for the facts of the case and to the interrogation strategy followed. Writing rules is a straightforward expression of legal doctrines in terms of the labels ascribed to particular facts.

The rules for delivering advice in the aggregate represent a kind of filter. Certain paragraphs will be printed only if all the elements of a breach of an implied contract are satisfied. If certain elements are missing, other paragraphs explaining the deficiency would be presented instead. For example:

advice if implied__contract(promise (form(oral)__),__) and write
("Oral promises are no less enforceable than written ones, and an oral promise is more likely to be associated with face-to-face discussions, which enhances the likelihood that employee reliance on the promise will be found to have been reasonable. On the other hand, oral promises are much harder to prove than written ones. You may want to consider whether there are witnesses to the communication or whether the employer will admit it, before going forward.")

advice if implied__contract(promise(form(oral), content(cause))), con-

163. Professor Hugh Gibbons suggested these three applications to the author during a conference at Franklin Pierce Law Center. See *infra* note 171 and accompanying text.

164. Such a system is under development at Northeastern University School of Law.

sideration(detrimental(W,X,Y,Z)) and not(W=nil) and not(X=nil) and not(Y=nil) and not(Z=nil) and write("You have a nearly perfect case for breach of an implied-in-fact contract arising from the oral promise of dismissal only for cause. Chapter 4 discusses this theory and chapter 7 gives points on burdens of proof and evidence. Interrogatories 1-34 in Appendix B may help with discovery.").

advice if implied__contract(promise(form(oral), content(cause))), consideration(detrimental(W,X,Y,Z)) and not(W=nil) and not(X=nil) and not(Y=nil) and Z="continued employment" and write("You would have a good implied-in-fact contract theory except that, traditionally, a promise may be enforced only if it is supported by consideration. Typically, in an informal employment contract case, consideration is satisfied by detrimental reliance. The problem is, most courts find mere continuation of employment to be insufficient reliance. You may want to use *Woolley v. Hoffman-Laroche*, in which the supreme court of New Jersey held that an employer promise of employment security might be enforceable even without individual detrimental reliance.").¹⁶⁵

Once rules for a guided analysis system are written, however, the question remains: how should the analysis and conclusions be presented to the user? One aspect of this question has been raised already: should the user be asked to evaluate sources of public policy and the jeopardy and justification elements as a part of the question and answer exchange, or should these essentially legal questions be saved for presentation during delivery of advice?

The Pascal version of the wrongful dismissal expert system completes the questioning before presenting analysis and advice. The connection between the questioning phase and the analysis generation can be described as a ray connecting points which represent the factual characteristics of the case.¹⁶⁶ The program checks each point along the ray (each fact) and produces appropriate analysis "paragraphs."

A fundamentally different approach is to present advice or analysis to the user as each question is answered, or at least when the user has completed enough questions for a legal conclusion about an element of the legal theory to be reached. The alternatives are closely analogous to the question of whether an attorney interviewing a client would react to each answer as the client provides it or whether the attorney would take notes and sum up his or her advice at the end of the questioning. Most counsel would prefer the latter.

165. An example of the actual advice produced by the current version of the Prolog system is reproduced at Appendix C.

166. This ray can be described as a set of entries in a database record.

The advantage of a more interactive approach is that the user receives legal analysis as he or she answers questions and may thus be more motivated with respect to answering further questions. Also, the interactive giving of advice simplifies the programming because the saving of all factual information is not necessary for the later generation of advice. Interactive advice-giving permits the combining of the rule and the question—asking the user whether a specific promise was honored and, if the user answers “yes,” advising the user immediately that no breach of that promise exists.

The major difficulty with the interactive approach to advice-giving is that the user receives the advice in fragmentary fashion. If the program is to be used by a paraprofessional or the client and the results saved and evaluated later by a specialized attorney, the advice should be preserved and presented in a comprehensive way. Comprehensive packaging and presentation of advice is also consistent with the underlying strategic purpose of the program: to collect and marshal facts, permitting advice for further legal analysis, rather than to decide the ultimate question about whether a cause of action exists.

Of course, there is no reason why advice cannot be given twice: first, interactively to the user, and later, comprehensively to the lawyer. The interactive approach can preserve advice by writing each advice paragraph to a transcript file at the same time it is given to a user. A subsequent reviewer might get a transcript of advice intermingled with questions, or a separate document or file with only the advice portions of the transcript.¹⁶⁷

Analysis produced by the system can be used in at least two different ways. One use is to provide both interviewer and interviewee with a summary of the theories that appear to be worth exploring. Another use is to provide a summary of the interview to an attorney with expertise in dismissal law. The contents of the analysis may need to be different depending upon the intended use. If a knowledgeable attorney is to use the analysis, it should be organized to facilitate further research and fact investigation. If the analysis is intended to inform the interviewee,

167. From a programming standpoint, advice paragraphs can be written to a file as they are presented, or they can be stored in a list and subsequently presented or written to the file. The disadvantage of using a file is that it complicates user set-up and management of floppy diskettes. For example, the program might terminate prematurely if the user does not have a formatted diskette with adequate space on it in the appropriate drive, or if a diskette is write-protected. On the other hand, saving the textual advice paragraphs to memory as the program proceeds greatly increases the memory required to run the program, and may exceed the capacity of Turbo Prolog to handle the memory requirements.

it should emphasize explanations of the legal theories and what facts are of significance in selecting and rejecting alternative theories.

VI. LEGAL EXPERT SYSTEM APPLICATION

As explained earlier, the legal expert system discussed in this Article is intended as a diagnostic tool for the evaluation of potential cases and the identification of fruitful areas for further fact gathering and research. Part VI of this Article summarizes lessons learned in the development and testing of the wrongful dismissal expert system, expands on the manner in which the diagnostic function is performed, and speculates on future uses or enhancements of this or other legal expert systems.

Several difficult problems are revealed by the development effort. Writing an expert system is useful in itself, regardless of the utility of the resulting system. When a lawyer is forced to articulate legal principles narrowly, arranging them in precise terms and syllogisms, the lawyer is forced to understand clearly the underlying principles and to identify alternative formulations.¹⁶⁸ The hardest part of the programming task is to formulate user questions in terms of concrete evidentiary facts rather than legal conclusions. The utility of a diagnostic system over time is impaired by any limitations on accommodating new analytical approaches in the rule base. Computer phobia is a more significant impediment to effective use of expert systems than is programming or conceptualization. It is difficult to anticipate how to employ the computer in the initial interview without distorting the human nature of the interview interaction.

Small diagnostic expert systems like WDES have several potential applications despite their limited sophistication. The wrongful dismissal expert system was designed as an aid for initial screening of employee termination cases to determine whether cases for recovery of damages under any of the three basic theories for recovery are presented. Either the original system or the one described in this Article can be used by an attorney with experience in wrongful dismissal cases, by a secretary or paralegal, or by the client.

System utility depends on user expertise. Even for users with substantial employment law expertise, the system provides a structured way to obtain information from a client, ensuring that no legally material information is omitted. Additionally, it provides a summary of the

168. See Allen, *supra* note 37; Allen & Orechkoff, *supra* note 37; Comment, *supra* note 33.

client interview, including guidance for further factual and legal research. These features would be valuable regardless of the qualifications of the user.

But intelligent counsel, even lacking specialized expertise in employee dismissal law, would develop an adequate understanding of the theories after exposure to only a few cases. Such counsel well might find it more efficient to make use of his legal knowledge to interview a potential client without the assistance of the system.

The main economic benefit of WDES is in lowering the skill level required to conduct a thorough initial interview. In effect, WDES is a sophisticated, computerized checklist for a secretary or a paralegal.

Certain application issues operate independently of user expertise. A prime example is the significant psychological impact of computer participation in the interview process. Empathy between interviewer and interviewee is important in any professional setting.¹⁶⁹ If the interviewer uses a micro-computer system to assist in the interview, empathy may be reduced by the presence of the computer, by interviewer reference to the video display, and by keyboarding of responses to questions. Asking a client to use the system directly may give the client the impression that inadequate professional skill or attention is being applied by the attorney and his or her support staff.

However, the increasing use of computer terminals to facilitate initial data gathering in many different settings, such as doctors' offices, may give the client the impression that the attorney is well organized and making use of all modern aids. The client might also believe that the use of computer analysis will result in more effective legal research. Direct client use also reduces the law office personnel resources required to perform initial data collection.

VII. FURTHER DIRECTIONS FOR DEVELOPMENT

This Article demonstrates that legal expert systems performing diagnostic functions are feasible and can be developed for micro-computer application. The knowledge representation and interrogation strategy issues are not trivial; intelligent choices can be made. The utility of such systems, however, depends on the degree to which there is a demand to automate the initial review of facts of potential cases. Until the profession gains more experience with such systems, one cannot say

169. See generally G. BELLOW & B. MOULTON, *supra* note 94, at 124-339 (emphasizing psychological and non-verbal aspects of interview process).

with confidence that they promise significant productivity or effectiveness improvements.

Some enhancements might be feasible within the constraints imposed by memory and speed limitations of a personal computer. For example, a wider variety of help and reason messages could be included in the Prolog program. Thus, the user who experiences uncertainty regarding how to answer a particular question can press a particular key, such as the H (Help) key, and receive further advice on choosing the correct answer. This feature is included in the original WDES software and is included for certain of the implied contract questions in the Prolog version. A similar feature permits the user to obtain an explanation of the rationale or reason for which a particular question is being asked. This advice can be obtained in any question by pressing a particular key, such as the R (Reason) key. This feature also was included in the original WDES and is included to a limited extent in the Prolog version.

The Prolog version discussed in this Article does a minimal amount of natural language processing. When the user describes the conduct that might form detrimental reliance to support an implied contract claim, the program determines whether the description of the conduct begins with a pronoun. If it so begins, the program eliminates the pronoun before using the description for subsequent questions.

An additional type of natural language processing which would be desirable and might be feasible within the constraints of the personal-computer-sized hardware follows. A table could be made relating the statutes potentially supporting a public policy claim to the kinds of harm threatened by various types of employer conduct. For example, if the employee used the word "falsify" and identified "investors" as the class potentially jeopardized by the employer's conduct, then the table could suggest the specific statutes protecting investors against securities fraud which the attorney should consider. Or, if the word "pollution" were used and the general public identified as the jeopardized class, then the table could direct the attorney to specific environmental statutes.

The use of other enhancements, such as a more elaborate natural language processing system, would be feasible on larger machines but does not appear to be feasible on personal computers. The state of the art in expert system development is advanced in areas such as natural language processing and the other features discussed immediately below; however, many of these more sophisticated techniques require more memory and speed than personal computers can provide.

In addition to natural language, a greater degree of what might

loosely be called "self-awareness" is desirable to permit a user to find out how the system reached a particular conclusion. Such self-awareness can be included relatively easily by adding variables that essentially trace the path of the inference engine in trying to satisfy sub-goals. The path then can be recalled at any point to explain where the system has been and where it is trying to go.

An area in which productivity gains could be substantial involves a fundamentally different application of artificial intelligence concepts to legal analysis: use of automated inductive reasoning to derive rules and principles from decided cases. The facts of a decided case, like those of a potential case, can be represented as a set of entries in a (possibly complex) database record. Such a representation of the facts of individual cases permits the comparison of cases and the generalization of legal rules. Thus, a computer program could synthesize certain rules of cases, or could identify areas in which pre-programmed deductive rules must be supplemented by new rules necessary to accommodate the facts of newly decided cases.

Inductive reasoning is possible using predicate calculus through a language like Prolog. Decided cases can be represented by a series of predicates which encodes their facts. An additional predicate would represent the court's decision. Then, by means of a pattern-matching algorithm,¹⁷⁰ the computer could induce a rule reflecting the characteristics of the cases. There are major practical hurdles in computerizing inductive legal reasoning. One such hurdle is a knowledge representation problem. The other is a data entry problem.

This Article illustrates a knowledge representation system which can evaluate (i.e. decide) easy cases. Knowledge representation systems capable of deciding hard cases are much more difficult to develop. Hard cases require inductive reasoning based on attributes of decided cases that are extremely difficult to predict in advance. One of the characteristics of a good judge or a creative lawyer is that he or she perceives common threads (attributes) in the case law not previously seen by others as important. Automating this process would necessitate a knowledge representation system based on yet-undiscovered attributes, an obvious non sequitur.

The data entry problem arises because, once a knowledge representation system that is sufficiently useful for all cases in a particular area of the law is developed or discovered, the enormous body of data represented by the universe of state and federal case law must be reclassified

170. Similar to the one described in Koulokouris, *Machine Learning*, BYTE, Nov. 1986, at 226.

or indexed in the new representation system. Anyone who authors a legal treatise and then updates it with new cases faces a roughly comparable task. The author must review recently decided cases and decide where (if at all) these cases should be referenced in the treatise supplement. Entering the key facts of cases into an inductive expert system would require an even more refined level of analysis.

At a conference on Intelligent Systems and Law at the Franklin Pierce Law Center on April 4, 1987,¹⁷¹ three points emerged. First, intelligent legal systems span a continuum. At the low end are mail merge document generators created on word processors. These systems can generate documents such as wills or tailor-made opinion letters based on user responses to questions. At the high end are systems written in the artificial intelligence languages LISP or Prolog, which make it easy for an expert to provide procedural knowledge, permit a user to provide transaction knowledge and to control the level of detail of the questioning, and provide a high level of intelligent output, either in the form of recommendations to an attorney or a legally significant document like a will or contract closely matching the particular transaction.¹⁷²

Second, the greatest impediments to wider use of intelligent legal systems are lawyer antagonism toward the use of computers in law practice, and the reluctance of lawyers to commit the time necessary to provide expert knowledge to the system. Closely related antagonisms relate to the usual inflexibility of the query module on such systems, requiring a user to answer a great many specific questions even if the user already knows the answer to an over-arching question.¹⁷³

Third, as part of Project Pericles at Harvard University, knowledge acquisition research that would reduce the investment required to transfer expert knowledge into an intelligent legal system is under way.¹⁷⁴

These three conclusions are helpful in defining the boundaries of further development of the specific ideas addressed in this Article.

VIII. SUMMARY

Lawyers and judges cannot be replaced by computers. Certain discrete activities engaged in by lawyers and judges, however, can benefit

171. The author attended the conference and personally participated in the discussion summarized in the text.

172. See *supra* note 171.

173. See *supra* note 171; see also MacRae, *User Control Knowledge in a Tax Consulting System*, in *ARTIFICIAL INTELLIGENCE IN ECONOMICS AND MANAGEMENT* 193 (L. Pau ed. 1986).

174. See *supra* note 171.

from application of artificial intelligence techniques such as logic programming. Logic programming, as embodied in the computer programming language Prolog, permits a computer to perform the essentially mechanical functions of applying a checklist to evaluate a legal dispute, thereby allowing for future focus of legal research and fact investigation efforts.

This Article described an effort to write a Prolog program that evaluates employment terminations by asking a series of questions about the facts surrounding the termination. Once the questions have been answered, the program uses a series of rules to develop advice about the strengths and weaknesses of employee common law claims. This Article has explored the issues which must be confronted in translating legal doctrine into the rules to be applied by such a program, and the even more difficult challenges of defining the details of the interrogation process and the form of the output.

Legal expert systems as aids in evaluating cases can be developed, but their developers must be careful to retain a narrow scope and structure which satisfy clearly defined lawyer and client needs.

APPENDIX A

Question and Answer Transcript for Implied-in-Fact Contract

We are now considering Implied-in-Fact Contract theories.

1. Did the employer and employee have a specific written agreement relating to how long employment would last, or the manner in which it could be terminated?
Please answer (y)es or (n)o
y
2. Did the employer promise only to dismiss for just cause?
Please answer (y)es or (n)o
n
3. Did the employer specify certain reasons for which termination could occur?
Please answer (y)es or (n)o
n
4. Did the employer promise that terminations would occur only after certain procedures were followed?
Please answer (y)es or (n)o
n
5. Did the employer make an explicit promise that employment would last for a definite period of time?
Please answer (y)es or (n)o
y
6. Did the employer make an oral statement regarding how long employment would last, or the manner in which it could be terminated?
Please answer (y)es or (n)o
y
7. Did the employer promise only to dismiss for just cause?
Please answer (y)es or (n)o
y
8. Did the employer specify certain reasons for which termination could occur?
Please answer (y)es or (n)o
n
9. Did the employer promise that terminations would occur only after certain procedures were followed?
Please answer (y)es or (n)o
n

10. Did the employer make an explicit promise that employment would last for a definite period of time?
Please answer (y)es or (n)o
n
11. Was the employee covered by a handbook that contained provisions relating to employment security or the reasons for which, or manner in which, employment could be terminated?
Please answer (y)es or (n)o
n
12. Did the employee pay money to the employer in return for the promise of employment security?
Please answer (y)es or (n)o
y
13. Did the employee transfer or assign property to the employer in exchange for the promise of employment security?
Please answer (y)es or (n)o
n
14. Did the employee promise to continue his employment for a particular length of time or until something specific happened?
Please answer (y)es or (n)o
y
15. Did the employee promise not to compete with the employer after leaving the employer's service?
Please answer (y)es or (n)o
n
16. Did the employee know of the employer's oral statement to dismiss only for good cause when the employee promised to continue working?
Please answer (y)es or (n)o
y
17. Did the employee know of the employer's oral statement to dismiss only for good cause when the employee paid money to the employer?
Please answer (y)es or (n)o
y
18. Did the employee know of the employer's written communication to the specific employee to dismiss only after expiration of a specific term when the employee promised to continue working?
Please answer (y)es or (n)o
y

19. Did the employee know of the employer's written communication to the specific employee to dismiss only after expiration of a specific term when the employee paid money to the employer?

Please answer (y)es or (n)o

y

20. Did the employee give up something because of an expectation of job security?

Please answer (y)es or (n)o

y

21. Type a sentence describing what the employee gave up.

He quit another job.

22. Did the employee know of the employer's oral statement to dismiss only for good cause when the employee quit another job?

Please answer (y)es or (n)o

y

23. Did the employee know of the employer's written communication to the specific employee to dismiss only after expiration of a specific term when the employee quit another job?

Please answer (y)es or (n)o

y

24. Did the employee quit another job because of the employer's written communication to the specific employee to dismiss only after expiration of a specific term?

Please answer (y)es or (n)o

y

25. Is it reasonable to infer that the employer made the written communication to the specific employee to dismiss only after expiration of a specific term for the purpose of inducing employees to quit another job?

Please answer (y)es or (n)o

y

26. Should the employer have known that an employee might quit another job because of the employer's written communication to the specific employee to dismiss only after expiration of a specific term?

Please answer (y)es or (n)o

y

27. Was it reasonable for the employee to quit another job in reliance on the written communication to the specific employee to dismiss only after expiration of a specific term?
Please answer (y)es or (n)o
y
28. Did the employee quit another job because of the employer's oral statement to dismiss only for good cause?
Please answer (y)es or (n)o
n
29. If you want to stop, type the letter n at the prompt. Otherwise we will proceed to consider the Implied Covenant theory.

APPENDIX B

Transcript of Questions and Answers on Termination Itself

We are now considering the facts surrounding the termination.

1. Did the employer say that a reason for the dismissal was that the employer had no further need for the employee's services, due to business decline or reorganization?

Please answer (y)es or (n)o

n

2. Did the employer say that a reason for the dismissal was that the employee's job performance was unsatisfactory?

Please answer (y)es or (n)o

n

3. Did the employer say that a reason for the dismissal was that the employee engaged in misconduct on the job?

Please answer (y)es or (n)o

y

4. Did the employer say that a reason for the dismissal was that the employee engaged in misconduct off the job?

Please answer (y)es or (n)o

y

5. Did the employer say that a reason for the dismissal was that the employee was personally incompatible with a supervisor?

Please answer (y)es or (n)o

y

6. Did the employer say that a reason for the dismissal was that the employee was personally incompatible with fellow employees?

Please answer (y)es or (n)o

n

7. Did the employer say that a reason for the dismissal was that the employer declined to give any reason at all?

Please answer (y)es or (n)o

n

8. Is it true that before or after the dismissal the employee received warnings, suspensions or probation?

Please answer (y)es or (n)o

y

9. Is it true that before or after the dismissal the personnel department reviewed the decision to terminate?
Please answer (y)es or (n)o
n
10. Is it true that before or after the dismissal higher supervision reviewed the decision to terminate?
Please answer (y)es or (n)o
n
11. Is it true that before or after the dismissal the employee was permitted to file a grievance or complaint about the dismissal decision?
Please answer (y)es or (n)o
n
12. Is it true that before or after the dismissal the employee received some form of severance pay?
Please answer (y)es or (n)o
n
13. Is it true that before or after the dismissal the employee agreed to release or waive claims against the employer?
Please answer (y)es or (n)o
n
14. Was the dismissal accompanied by restrictions on the employee's freedom of movement?
Please answer (y)es or (n)o
n
15. Was the dismissal accompanied by physical contact with the employee's body, or threats of such contact?
Please answer (y)es or (n)o
n
16. Was the dismissal accompanied by unusually abusive tone or manner by the person communicating the dismissal?
Please answer (y)es or (n)o
n
17. Was the dismissal accompanied by communications about the employee's dismissal, conduct or work performance to others?
Please answer (y)es or (n)o
n

18. Did the employer object: the employee filed a claim for benefits, such as a workers compensation claim?

Please answer (y)es or (n)o

n

19. Did the employer object: the employee performed service as a citizen, such as jury service?

Please answer (y)es or (n)o

n

20. Did the employer object: the employee took part in a political campaign?

Please answer (y)es or (n)o

y

21. Did the employer object: the employee made a public statement on an issue of public concern?

Please answer (y)es or (n)o

n

22. Did the employer object: the employee voted or refused to vote in a particular way?

Please answer (y)es or (n)o

n

23. Did the employer object: the employee was a member of an organization?

Please answer (y)es or (n)o

n

24. Did the employer object: the employee was an officer or was otherwise prominent in the affairs of an organization?

Please answer (y)es or (n)o

n

25. Did the employer object: the employee associated socially with a specific person?

Please answer (y)es or (n)o

n

26. Did the employer object: the employee was single, married or divorced?

Please answer (y)es or (n)o

y

27. Did the employer object: the employee used drugs?

Please answer (y)es or (n)o

y

28. Did the employer object: the employee used alcohol?
Please answer (y)es or (n)o
n
29. Did the employer object: the employee was accused of a crime?
Please answer (y)es or (n)o
n
30. Did the employer object: the employee was homosexual or was
suspected of being homosexual?
Please answer (y)es or (n)o
n
31. Does the employee dispute that the employee was personally
incompatible with a supervisor?
Please answer (y)es or (n)o
y
32. Does the employee dispute that the employee engaged in
misconduct off the job?
Please answer (y)es or (n)o
y
33. Does the employee dispute that the employee engaged in
misconduct on the job?
Please answer (y)es or (n)o
y
34. If you want to stop, type the letter n at the prompt. Otherwise we
will proceed to consider Public Policy Tort theories.

APPENDIX C

Transcript of Advice on Implied-in-Fact Contract

I conclude that you have one or more good claims that an implied-in-fact contract existed.

1. You have a potential case for an implied-in-fact contract, based on the employer's written communication to the specific employee obligating the employer to dismiss only after expiration of a specific term. Regardless of the availability of traditional bargain theory consideration, the promise can be enforced under the promissory estoppel theory. The employee suffered a detriment because of the promise, in that the employee quit another job. The detriment was reasonable, and the employer should have known that this sort of detrimental reliance was likely to result from the promise.

2. You have a potential case for an implied-in-fact contract, based on the employer's written communication to the specific employee obligating the employer to dismiss only after expiration of a specific term. The promise cannot be enforced because, despite the employee's reliance on the promise, in that the employee quit another job, the employer did not make the promise for the purpose of inducing this type detriment, thus defeating the bargain theory of consideration.

3. You have a potential case for an implied-in-fact contract, based on the employer's oral statement obligating the employer to dismiss only for good cause. The promise cannot be enforced because, despite the employee's reliance on the promise, in that the employee quit another job, the employee did not suffer the detriment because of the promise. Nor can the employee use the promissory estoppel theory because the reliance was not reasonable. The promise cannot be enforced because, despite the employee's reliance on the promise, in that the employee quit another job, the employer did not make the promise for the purpose of inducing this type detriment, thus defeating the bargain theory of consideration. Nor can the employee use the promissory estoppel theory because the one cannot say that the employer should have known that this type of reliance would result from the promise.

4. You have a potential case for an implied-in-fact contract, based on the employer's written communication to the specific employee obligating the employer to dismiss only after expiration of a specific term. The promise is enforceable because the employee gave consideration in

the form of paid money to the employer in exchange for the promise of employment security.

5. You have a potential case for an implied-in-fact contract, based on the employer's written communication to the specific employee obligating the employer to dismiss only after expiration of a specific term. The promise is enforceable because the employee gave consideration in the form of a promise to the employer to continue employment in exchange for the promise of employment security.

6. You have a potential case for an implied-in-fact contract, based on the employer's oral statement obligating the employer to dismiss only for good cause. The promise is enforceable because the employee gave consideration in the form of paid money to the employer in exchange for the promise of employment security.

7. You have a potential case for an implied-in-fact contract, based on the employer's oral statement obligating the employer to dismiss only for good cause. The promise is enforceable because the employee gave consideration in the form of a promise to the employer to continue employment in exchange for the promise of employment security.

